rep.00014

Natural Environment Research Council

ARASF

Atmospheric Research Airborne Support Facility

Flight Data Catalogue

Flight

A478

13 September 1996

OXICOA — TACIA

ADDENDUM

The correct dates for each of the flights are as follows:-

475	9 September 1996
476	10 September 1996
477	11 September 1996
478	13 September 1996
479	16 September 1996
480	17 September 1996
481	19 September 1996

TACIA OXICOA AUG-SEPT 96 Flight Summary

Prepared by: Andrew Kaye and Hannah Richer

[1] A475 9/9/96 TACIA TEST FLIGHT 1 2 hr 40 min

A short test flight for the chemistry instrumentation was carried out. The ozone, peroxide and formaldehyde instruments performed well. PAN was found to be below the detection limit of the GC's. The CO instrument did not work well (showing a large variability in background measurements). After initial concerns about the NO background, the NO_{xy} instrument was found to operate satisfactorily on the two available channels (NO and NO2).

An anticyclone centred to the west of the UK provided possible TACIA type weather. However, delays, due to incomplete airworthiness certification, meant that there was insufficient time to search for plumes from the UK. However, a small local plume was encountered in the Bristol Channel (51.36N, 4.12E).

Data from this flight could possibly be used to validate emission data from South Wales.

[2] A476 10/9/96 TACIA TEST FLIGHT 2 4 hr 30 min

Instruments performed as in the previous test flight: The ozone, peroxide and formaldehyde instruments performed well. PAN was found to be below the detection limit of the GC's. The CO instrument did not work well (showing a large variability in background measurements). The NO background had improved and the NOxy instrument was generally found to operate well on the two channels (NO and NO2). However, on reaching maximum altitude difficulties were encountered on controlling the flow rate in the NO2 channel.

A persistent anticyclone centred to the west of the UK again provided TACIA type conditions. However, delays, due to instrument requirements, meant that there was limited time to search for plumes from the UK. However, cross wind runs were carried out at an interval of approximately 60 miles along the SW coast. Trajectory analysis is to be carried out to determine whether the same air mass was sampled twice. However, no particularly notable plumes could be distinguished from the ozone, carbon monoxide and formaldehyde data. However, useful background information was obtained.

[3] A477 11/9/96 OXICOA Airmass characterization Flight 6 hr 00 min

The presence of an occluded frontal system over Norway/North Sea facilitated the study of three different airmasses.

Profiles were successfully flown on both sides of the warm front, but there was not sufficient time to travel to the northern edge of the cold frontal surface. However the lowest levels of the second stack may have been north of the front.

Ozone, formaldehyde and PAN instruments worked well, but the CO background problem was not corrected and the NOxy NO2 channel flow problem had not been resolved.

[4] A478 11/9/96 TACIA TEST FLIGHT 3 2 hr 56 min

Thursday 12 September was used to install the NOy converters and rectify the CO instrument. The CO work was successful. However the NOy converters took longer than expected to complete. This resulted in a delayed take off.

Although primarily a TACIA instrument test flight the opportunity was taken to characterise the Arctic Maritime air mass over the North Sea. This effectively completed the work started on A477.

The chemistry kit performed as well as could be expected given the reduced warm up

times available. The ozone pump switched off unexpectedly during the flight which caused a loss of data until the problem was identified.

[5] A479 11/9/96 TACIA 5 hr 40 min

There was a high pressure centred over the North Sea on this day which gave rise to continental outflow in the south-west approaches.

A very successful trial of the TACIA flying pattern, with two stacks being flown to sample continental air. A double inversion (875 and 950 mbar) was identified effectively capping pollutants and isolating them from the ocean surface sinks. Elevated levels of aerosol, CO (170 ppb), NO (40 ppt), NO2 (400 ppt) and O3 (65 ppb) were noted in this layer. Another interesting parcel of air was also sampled at higher altitudes (6 - 8 km). This air parcel was characterised by high levels of CO and aerosol. All the chemistry instrumentation performed well and the flight will provide a valuable contribution to the TACIA experiment.

[6] A480 11/9/96 OXICOA Airmass characterization Flight 6 hr 04 min

An anticyclone was centred to the north of the North Sea, such that continental plumes from northern Europe were reaching southern England across the North Sea. The same anticyclone was investigated during flight A479, at which time the high was centred over the UK.

The aim of this flight was to characterise air parcels within the anticyclone: both air parcels with recent continental influence and those with mainly marine back trajectories were studied. The highest pollutant concentrations of the campaign were measured during this flight in the boundary layer near Boscombe Down and in the marine boundary layer in the southern North Sea.

The marine boundary layer was distinct from the rest of the troposphere by a low level inversion. A slightly higher inversion was also apparent in profiles carried out north of 54 N. Interestingly, the seemingly typical vertical structure was not found in the southern North Sea: only the marine inversion was present.

A plume was encountered in the marine boundary layer at the first sampling region and elevated NOx, NOy and CO were observed with a corresponding decrease in ozone, indicating recent anthropogenic inputs. Profiles throughout the lowest 6000 ft of the atmosphere, whilst travelling northward, indicated some chemically aged parcels of air with elevated ozone, CO and NOy. Haze layers were also visible. However, most of the air was generally clean. Further North, haze layers were less frequent, but layers with elevated ozone were still apparent. Elevated CO with a corresponding decrease in ozone indicated some recent pollution in the marine boundary layer at 57.2 N and 0.8 E.

All the chemistry instruments performed well during the flight. In particular, the peroxide measurements were found to show similar features to the calculated peroxide. Pitch, roll and yaw manoeuvres were carried out in order to test the NOxy inlets: preliminary results indicated that there were no large effects.

[7] A481 11/9/96 OXICOA Airmass characterization Flight/NOXY test 6 hr 16 min

An attempt was made at an airmass characterization flight. However, within an hour of take off, the peroxide and CO instruments had failed completely and the NOxy was only functioning at 50%. After consultation with the instrument operators it was decided that useful tests could still be carried with the operational NOxy channels and the flight plan was changed to a NOxy test flight. Several NILU and MRF bottles were also filled for analysis of hydrocarbons and possibly CO.

However, it is interesting to note that, at one point, air of stratospheric origin was encountered: we were frustrated by the lack of a complete suite of instruments. Recently polluted air and air which was chemically aged, as indicated by ratios of NOx/NOy and ozone, were both sampled. Useful data on emissions from north eastern Europe may have been gained.

FLIGHT FOLDER

Flight No. A 478

DATE: 13/09/96

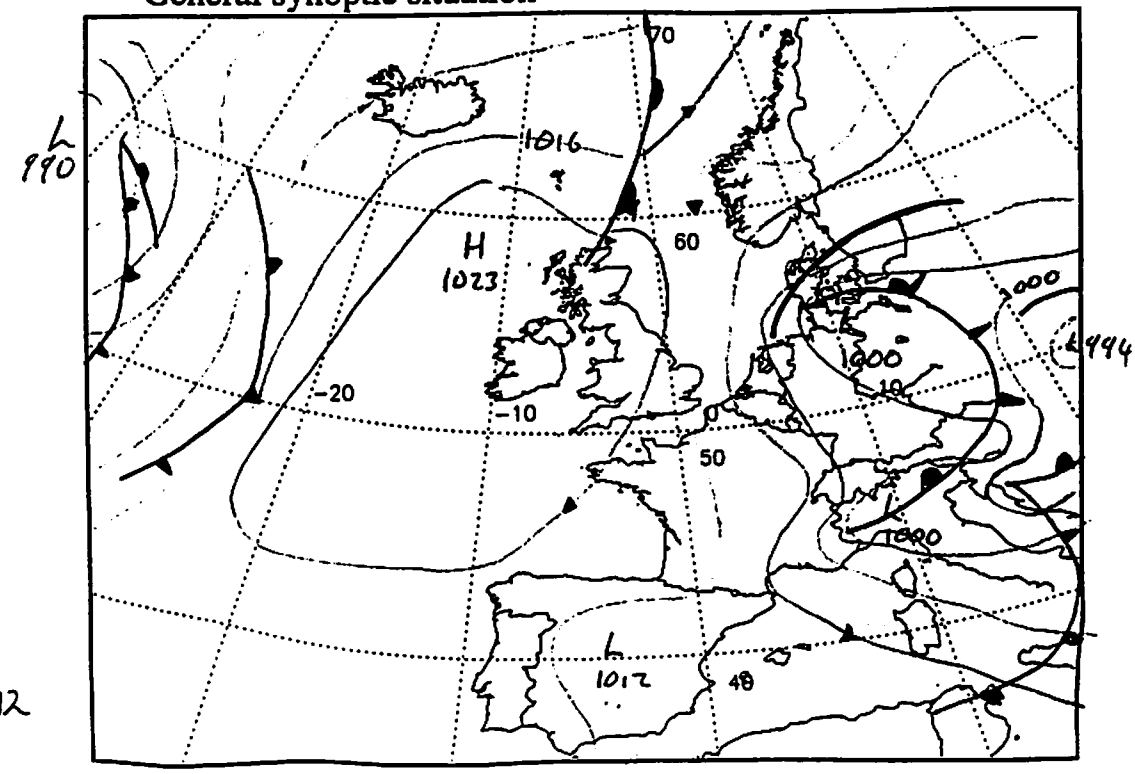
Take off : 12:30
Landing : 15:25

Aircraft Scientist : A KATE + M RICHER
Flight Leader : D PERCIVAL
Others 2D : M PICKERING
O_3 : J KENT
NOXY : MDEWEY / S BAGUITTE
CO : S KESSLER / K GERRIG
H_2O_2 : B BANDY / L GARDINAS
BOTTLE : D TIDDEMAN

Captain : FLT LT M PURSE
Co-pilot : FLT LT C WILLIAMS
Navigator : MR E HEATON (RAF RTD)
Engineer : M. ENG K QUICK
Loadmaster : FLT LT J CANNING

Trials Instructions TACIA / ACSOE : MRF 13
Operating area : NORTH SEA

General synoptic situation



TIME : 12

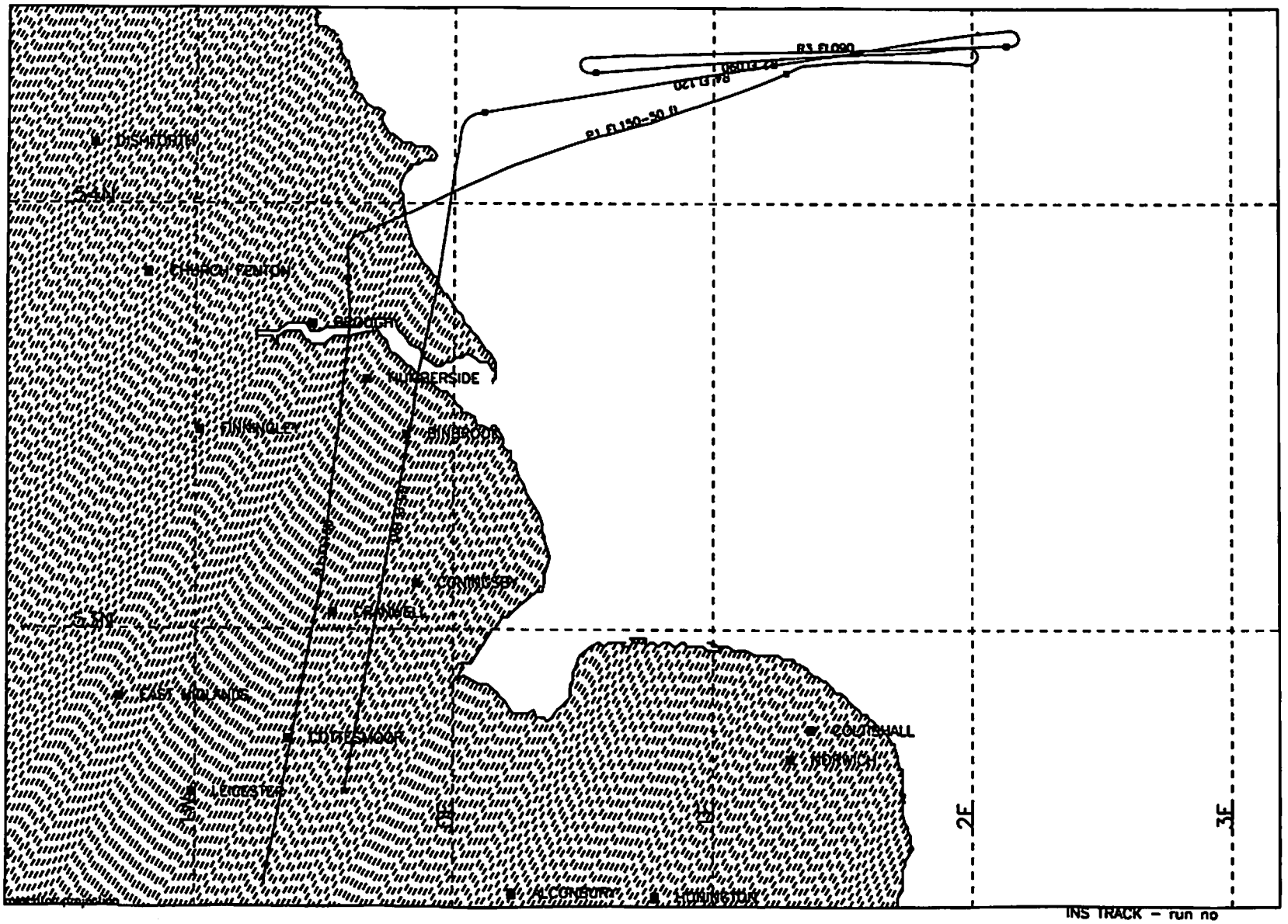
LIST OF FORMS USED ON FLIGHT

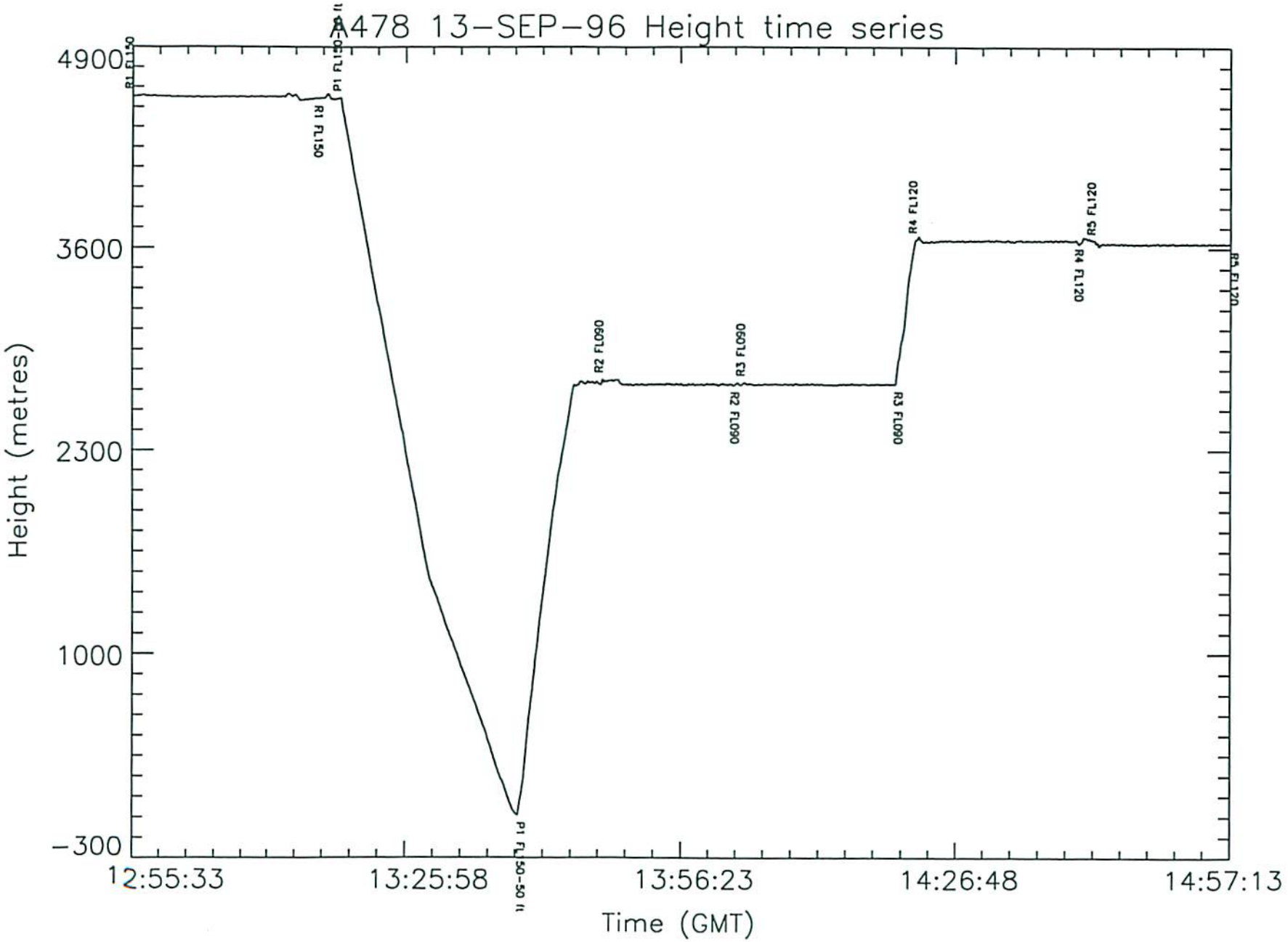
No. of forms	Form Title
2 1 1	Aircraft Scientist de-briefing sheet Aircraft Scientist log Aircraft Scientist post flight requirements sheet Interactive log
1 of 2 2 of 2 1 1	Flight Leader pre-flight check form Flight Leader in-flight check form Flight Leader in-flight log Flight Leader Video tape log (photocopy original)
	SAFIRE log CCN log MARSS log DEIMOS log Chemistry log
1 3	Particulate / Filter boom Operator's log 2DC / FSSP / Holography Operator's log Sonde Ejector's log Navigator's log Photographic log (photocopy original)
1 1	Instrument status forms RTD prints Raw data plots Weather charts Satellite pictures GPS track

FLIGHT REPORT A478 13/09/96 TACIA

Time 1	E.M.	Time 2	E.M.	Event	Height	Heading	
12:30:35				TAKE OFF BOSCOMBE DOWN			
				Transit to North Sea via Daventry Corridor			
12:55:33	(15)	13:15:53	(16)	Run 1	FL150	015°	Calibrations 250 kt IAS
13:18:45	(17)	13:28:38	(18)	Profile 1	FL150 FL050	060°	1000'/min
13:28:38	(18)	13:38:22	(19)	P 1 cont	FL050 50 ft	060°	500'/min Sea State 7
13:47:47	(20)	14:02:01	(21)	Run 2	FL090	280°	
14:03 28	(22)	14:20:01	(23)	Run 3	FL090	085°	
14:22:27	(24)	14:40:01	(25)	Run 4	FL120	270°	
14:42:12	(26)	14:57:13	(27)	Run 5	FL120	195°	Calibrations 250 tk IAS
				Transit to Boscombe			
15:24:28				LAND AT Boscombe Down			
15:29:01				Data off. Shut down at 51°09.88N 001°44.66W			

A478 13-SEP-96 12:55:33-14:57:13GMT




A478 13-SEP-96 Height time series
4900
3600
2300
1000
-300
Height (metres)
12:55:33
13:25:58
13:56:23
14:26:48
14:57:13
Time (GMT)
R1 FL150
P1 FL150-50
P1 FL50-150
R2 FL090
R3 FL090
R2 FL090
R3 FL090
R4 FL120
R5 FL120
R4 FL120
R5 FL120

Sortie Brief: TACIA - Instrument Test Flight

Sortie Objective: To test the NOy channel of the NOxy instrument and also determine chemical characteristics of an Arctic maritime air mass.

Operational Area: North Sea.

Weather conditions: Avoid areas of cloud and precipitation where possible.

Flight Pattern:

1. Depart Boscombe Down (12:00 local) maintaining altitude at 3000ft until wet chemistry instruments are checked.

2. Profile ascent to FL150 maintain horizontal run for 20 minutes.

3. Profile descent into operational area (as normal).

4. ~~Sawtooth in and out of boundary layer for 30 minutes~~.

5. Carry out racetrack perpendicular to wind direction, above boundary layer. Reciprocal run turning into wind to avoid C130 exhaust (40 mins total).

6. ~~Repeat [5], at different level.~~

7. ~~Left hand orbit followed by a right hand orbit (above boundary layer).~~

8. Three straight and level runs, five minutes each, ~~at different angles of attack~~ (above boundary layer).

9. Two straight and level ~~runs, five minutes~~ each, crabbing left then right (above boundary layer).

10. ~~Fifteen minutes in boundary layer for instrument calibration.~~

11. Transit to Boscombe Down, maintaining constant altitude (above boundary layer) for 15 minutes. Arriving Boscombe Down at 16:30 local.

Other requirements: Constant pressurisation on horizontal runs (not required for [7,8,9]).

MP P1
C Williams P2
EM N
HG E
JC LM

AIRCRAFT FLYING PROGRAMME

DATE 13th September FLIGHT NO A478

FTI MRF 13 TACIA

Aircraft scientist	A Kaye
Flight leader	D Percival
Cloud physics	M Pickering
PAN/Ozone	J Kent
NOXY	K Dewey / S Baguitte
CO	S Kessler / K Gerbig
Peroxide	B Bandy / L Gardinas
Bottle Sampler	D Tiddeman
	+ H Richer

Pre-flight clearance D Boyd / D Findley dep 0730L
FTOs depart F'boro 0745L

Briefing 0900L Take off 1200L Return 1625L

Press RETURN for next display (H for help) TODAY 12-SEP-1996 15:46

POST FLIGHT REQUIREMENTS FORM

Flight No: A473 Date: 13 07 96 A/S Name: HAYE

Aircraft Scientist's Post Flight Requirements:

1. Are any copies of the flight folder required?
   YES ☑ NO ☐ for .....3.....

2. Flight data and folders will normally be discarded after 10 years, is this OK?
   YES ☒ NO ☑ If not OK, state period ....INDEF.....

3. Is the flight part of an international project or major campaign?
   YES ☑ NO ☐ Name of Project .....IACIA.....

4. Do you want the video tape kept?
   YES ☐ NO ☐ How long? .....INDEF.....

5. Has the Handheld camera or the Camcorder been used:
   YES ☑ NO ☐
   If yes, do you want the handheld camera film processed:
   immediately ☐ or when the film is finished? ☑ OF THE NIGHT.

6. Do you want the cloud physics data kept?
   YES ☑ NO ☐
   If yes, which disc / file do you want it stored in?.....

7. Do you want to do the interactive processing?
   YES ☑ NO ☐

NOTE:

- Members of MRF Radiation and Cloud Physics groups are expected to meet their own requirements for data storage and non-standard processing.
- For non MRF users, Data Management Section will keep the processed data TEMPORARILY until the requirements are made known.
- Any other requirements for post-flight processing and data storage should be discussed with the Data Management Section.
- If copies of the Flight Folder are required, it is the responsibility of the Aircraft Scientist / User to produce them.

AIRCRAFT SCIENTIST'S LOG

Project: Aerosol/Macm Date: 13/9/96

Aircraft Scientist: A Kaye & HARICHER. Flight No: A478 Page 1 of 2

GMT	Event Mark	Run No.	Height	Pres/Rad	INS Heading	Omega Pos'n Latitude / Longitude	Other Info. (eg. clouds, weather, visibility, winds, sea state etc.)	Photo No.
12:37:13		Transit	6.0	P	357	51.55 / -1.65	Small cu field. Clear above.	
12:46:21		Trans	10.1	FL	46	52.12 / -1.41	5/8 Thin cu layer.	
12:55:34	15	R1s	150	FL	10	52.41 / -0.71	4/8 Broken Sc. sheet. Clear above	
13:00:47	15	R1	151	FL	11	52.79 / -0.61	Broken Sc below clear Above.	
13:07:42	15	R1	151	FL	6	53.31 / -0.46	6/8 Sc. sheet below clear above	
13:15:52	15	R1e	150	FL	359	53.86 / -0.39	Broken Sc below. 1010	
13:23:28		P1	150	FL	356	54.00 / -0.11	5/8 Broken Sc sheets over sea.	
13:28:28	18	P1	4.7	FL	67	54.16 / 0.60	Change to 500ft/min.	
12:31:44	18	P1	32	FL	61	57.20 / 0.52	Hazy layer with rough sea below.	
12:38:22	19	P1e	570 ft	R	A		1018 sea state 7	
							FL90 & 150	
13:47:44	20	R2B	90	FL	272	54.36 / 1.94	5/8 Cu below clear and sunny above.	

AIRCRAFT SCIENTIST'S LOG

Project: Acsoe mcit Date: 13/9/90

Aircraft Scientist:

Flight No: N477 Page 2 of 2

GMT	Event Mark	Run No.	Height	Pres/Rad	INS Heading	Omega Pos'n Latitude / Longitude	Other Info. (eg. clouds, weather, visibility, winds, sea state etc.)	Photo No.
14:02:02		R2e	9.0	FL	275	54.32 / ~~0.73~~	Rapid ozone Change @ 1350 water vapour & Aerosol	
14 03:28		R3s	9.0	FL	81	54.32 / 0.51	2/8 Sc sheet Below solid Cu ahead?	
14:15:01		R3	9.0	FL		54.37 / 1.68	Cloud edge goes miles South & North	
14:20:02		R3e	9.0	FL	81	54.38 / 2.17	Smoke on field — WV route, but no ozone increase smoke in any windows	
14:22:27		R4	120				photographs taken of Ridge by clouds	
14:32:42		R4	120	FL	271	54.29 / 0.90	Sc sheet with large gaps. Cloud above on control flight?	
14:40:00		R4e	120	FL	270	54.22 / 0.10	Some bits of Sc over sea, solid Sc over land.	
14:42:00		R5s	12.0	FL	189	54.0 / 0.01	Ditto. High Speed run back NOxy cal.	
14:49:05		R5	120	FL	190	53.39 / -0.16	4/8 Cu below.	
14:54:40		R5	120	FL	190	53.90 / -0.29	7/8 Cu below.	
14:57:13		R5e	120	F	191	53.61 / -0.34	End of planned science!	

Interactive Processing Log

Flight No. A478 Date: 130996 User: CHEMISTRY
Interactive by: D PERCIVAL
Date: 17 0496

Renav

KALMAN FILTERING CHOSEN

TWC

Profile plotted :
Line chosen : ~~Profile~~ / Whole flight / ~~Other~~

a = − 0.3482E+01
b = + 0.2048E-02
c = + 0.6972E-06

LWC

OK

Heimann / ~~Barnes~~

OK

Flight Leader's Pre/In-Flight Check List

CHEK Flight No: A478 Date: 130996 Page 1 of 2
for auto selection

GMT	PARA	NO	D.R.S.	DECODE	INSTRUMENT	EXPECTED VALUES INFLIGHT | *PREFLIGHT*
1017	REF +	5	0567	✓		Approx 0568
	REF -	7	2855			Approx 2858
	AOSS	19	0000	F/S 2.0 O/S	TORQUE	2047 st. and level
	AOA	18	2009	F/S 3.0 O/S	TORQUE	2047 st. and level
	RD HT	37	0000	✓		As Indicated | 0000
	PR HT	8	3871	1004	1602	As Altimeter
	CABP	14	3980	1004		
	A/S	9	0074	20		As ASI | 0000 – 0100
	UP1S	81	1806	589	592	
	UP2S	82	1538	276	309	
	UIRS	83	0650	-273	1558	
	UP1Z	84	0152	✓		Approx 0147
	UP2Z	85	0146	✓		Approx 0149
	UIRZ	86	0648	INV2		Approx 2061
	UP1T	87	2457	19		As IAT
	UP2T	88	2480	18	17.5	As IAT
	UIRT	89	0000			As IAT
	LP1S	91	0473	130	129	
	LP2S	92	0401	65	63	
	LIRS	93	0123	-388	1559	
	LP1Z	94	0151	✓		Approx 0150
	LP2Z	95	0155	✓		Approx 0146
	LIRZ	96	0122	INV2		Approx 2050
	LP1T	97	2436	19		As IAT
	LP2T	98	2403	21	17.4	As IAT
	LIRT	99	0000	✓		As IAT
	J/W	42	0996	✓ ON1		As Indicated | 0000
	NEPH	47				
	HYGR	58	2595	3.6	3.7	
	HYCC	59	0721	✓		696–901
	FDEW	138	4095			DP = (DRSU/20)-100 C
	FSTA	139	4095			
	DTF	10	0614	17		
	DTC	11	6		17.2	
	NDTF	23	0185	16		same as De-Iced
	NDTC	24	6			
	INCT	48	4095			
HEIM	~~OCN~~	149	2635			less than 4095 if ON
	TWCD	70	2212	✓		0000–4094
	TSAM	72	0169	✓		0640–1860 | < min
	O3	100	0101	✓		
	O3P	106	2005	947		P≃ (DRSU × 0.4) + 145mB
	O3RG	113	1537	✓		
	PATC	142	2391			
	O3F	114	1027			

150	HCHO	0326	145	FIEL	1088	179	URTS	968
151	ORGP	0001	146	F1PR	1374	180	NBBS	875
152	H202	0003	147	F2FL	1508	181	UGTS	983
154	CC	0017	148	F2PR	1580	182	NRBS	1008
185	PMN	1283	0175	UPRS	291	183	NHUM	1022
186	PACC	1296	176	UTMP	892	184	NTTS	1041
			177	UGTS				

Flight Leaders' Pre/~~In~~-Flight Check List

BCDS for auto selection

GMT	PARA.	NO.	H/D	D.R.S.	DECODE	INSTR	EXPECTED VALUE
1107	FL NO	1	Hex	0478	A478	✓	Flight No.
	GMTH	2	Hex	0110	✓		Clock: First 4 No.s
	GMTM	3	Hex	0815	110815	✓	Clock: Last 4 No.s
	E/M	4	Hex	11→12	✓		Event Mark Counter
	INCH	49	Dec				Multipxd Hkeeping
				4	0	9	5
	LATC	160	Dec	4044			Latitude
	LONC	161	Dec	4044			Longitude
1109							

Total Water Content Meter Check List

TOTW for auto selection Height: PRE FLIGHT.

GMT	PARA	NO	D.R.S.	DECODE	INSTRUMENT	EXPECTED VALUES	
						INFLIGHT	*PREFLIGHT*
1109	TWCD	70	2213	✓		0001–4095	
	TNOS	71	1302	✓		2000–3460	< *min*
	TSAM	72	0143	✓		0640–1860	< *min*
	TAMB	73	2540	✓		2400–3200	
	TSRC	74	2266	✓		2160–2470	
	HTR1	75	2071	✓		0000–4095	< 4095
	HTR2	76	2125	✓		0000–4095	< 4095
	ISRC	77	1022	✓		0001–1230	< *min*
	STAT	78	4089			4095	
	EV1V	170	2043				
	EV2V	171	2043				
	NPWR	172	3314				
	EVIC	173	3968				
1115	EV2C	174	3968				

BROAD BAND RADIOMETER FIT (pre-Flight only)

	PARA NO	POSITION	DOME	COVERS	OBSCURERS
UPPER	81,84,87 82,85,88 83,86,89	Port Stbd Centre	Clear ✓ Red – Silicon ~~SNOT~~	(Off) / On	Large / (Small)
LOWER	91,94,97 92,95,98 93,96,99	Port Stbd Centre	~~Clear~~ ✓ Red ✓ ~~Silicon~~ ~~SNOT~~	(Off) / On	

Flight Leader's ~~Pre~~/In-Flight Check List

CHEK for auto selection Flight No: A478 Date: 130996. Page..2..of 2

GMT	PARA	NO	D.R.S.	DECODE	INSTRUMENT	EXPECTED VALUES INFLIGHT | *PREFLIGHT*
1237	REF +	5	567			Approx 0568
	REF -	7	2855			Approx 2858
	AOSS	19	1879	F/S O/S	TORQUE	2047 st. and level
	AOA	18	1502	F/S O/S	TORQUE	2047 st. and level
	RD HT	37	4095	FLIGHT		As Indicated | 0000
	PR HT	8	26888	102	FLIGHT	As Altimeter
	CABP	14	3998	983		
	A/S	9	2605	258	256	As ASI | 0000 – 0100
	UP1S	81	2063	680	646	
	UP2S	82	1687	308	343	
	UIRS	83	0864	-230	1558	
	UP1Z	84	154	/		Approx 0147
	UP2Z	85	147	/		Approx 0149
	UIRZ	86	854	/	INOP	Approx 2061
	UP1T	87	2644	9		As IAT
	UP2T	88	2664	8	12.4	As IAT
	UIRT	89	0000	/		As IAT
	LP1S	91	530	149	281	
	LP2S	92	652	130	133	
	LIRS	93	432	-330	1554	
	LP1Z	94	151	/		Approx 0150
	LP2Z	95	163	✓		Approx 0146
	LIRZ	96	450	/		Approx 2050
	LP1T	97	2748	4		As IAT
	LP2T	98	2750	4	4.3	As IAT
	LIRT	99	0000	INOP		As IAT
	J/W	42	1021	-0.1		As Indicated | 0000
	NEPH	47				
	HYGR	58	1803	-21.2	-20 ✓	
	HYCC	59	0758	/		696–901
	FDEW	138	593	-70.3	?	DP = (DRSU/20)-100 C
	FSTA	139	921			
	DTF	10	1144	3		
	DTC	11	5		4.2	
	NDTF	23	999	3		same as De-Iced
	NDTC	24	5			
	INCT	48	4095	✓		
HEIM	ECN	140	2492			less than 4095 if ON
	TWCD	70	1398	/		0000–4094
	TSAM	72	1393	/		0640–1860 | < *min*
	O3	100	152			
	O3P	106	1964	930.6		P≃ (*DRSU* x 0.4) + 145*mB*
	O3RG	113	779			
	PRTC	142	2393			
1308	O3F	114	1831			

150 HCHO 779 263
151 ORGP 0003
152 H2O2 0253
154 CO 0195
185 PLIN 1435
186 PLOC 1430
187 PTA 1407

195 FIFL 1028
196 FIPR 1157
197 F2PL 1179
198 F2PR 1239
175 NPRS 510
176 NTAP 1030
177 NATS 1012

179 NRTS 1115
180 NBBS 1032
181 NATS 1132
182 NRTS 1144
183 NHUM 1159
184 NTS 1172

Flight Leaders' ~~Pre~~/In-Flight Check List

BCDS for auto selection

GMT	PARA.	NO.	H/D	D.R.S.	DECODE	INSTR	EXPECTED VALUE
1410	FL NO	1	Hex	0478	A478	✓	Flight No.
	GMTH	2	Hex	0141	✓		Clock: First 4 No.s
	GMTM	3	Hex	212	✓		Clock: Last 4 No.s
	E/M	4	Hex	22	✓		Event Mark Counter
	INCH	49	Dec				Multipxd Hkeeping
			4	0	9	5	
	LATC	160	Dec	618	54.38N	✓	Latitude
	LONC	161	Dec	0016	1°4.03E	✓	Longitude
1412							

Total Water Content Meter Check List

TOTW for auto selection Height: FL120

GMT	PARA	NO	D.R.S.	DECODE	INSTRUMENT	EXPECTED VALUES	
						INFLIGHT	*PREFLIGHT*
1447	TWCD	70	1510	✓		0001–4095	
	TNOS	71	2516	✓		2000–3460	< *min*
	TSAM	72	1396	✓		0640–1860	< *min*
	TAMB	73	2676	✓		2400–3200	
	TSRC	74	2246	✓		2160–2470	
	HTR1	75	784	✓		0000–4095	< 4095
	HTR2	76	2183	✓		0000–4095	< 4095
	ISRC	77	1014	✓		0001–1230	< *min*
	STAT	78	4095			4095	
	EV1V	170	3480				
	EV2V	171	3136				
	NPWR	172	2701				
	EVIC	173	4019				
1453	EV2C	174	4007				

USS

BROAD BAND RADIOMETER FIT (pre-Flight only)

	PARA NO	POSITION	DOME	COVERS	OBSCURERS
UPPER	81,84,87 82,85,88 83,86,89	Port Stbd Centre	Clear Red Silicon	Off / On	Large/Small
LOWER	91,94,97 92,95,98 93,96,99	Port Stbd Centre	Clear Red Silicon	Off / On	

Flight Leader's In-Flight Log

Flight No A 478 ..... Date 13.09.96 ..... Page 1 of 1

Video Tape	
No.	A478#1
Ends	1539
FFC / DFC / RFC	

	GPS	INU
Lat	51° 09.88N	51°09.88N
Long	001°44.650	001°44.61W
Time	093111	093143
Status	Air.	AC ALIGN

DRS recording to HORACE (y) / n

HORACE recording to disc (y) / n

SATCOM sending pos. reports (y) / n

GMT	EVM	Height	QNH	Hdg	IAS	TAT	DP	DI Htr		Wind/ Sea st.
074129				DATA	ON					
121236				SET TO	NAV					
123035				TAKE OFF Boscombe.						
				Climb Descent for Transit.						
				START	RUN 1		-CALIB			
125533	15	FL150	1013	015	250	-8.2	-23.6	OFF		013/23
				END	RUN 1					
131553	16	FL150	1013	005	180	-9.6	-17.8	OFF		002/20
				START	P1					100ft/m
131845	17	FL150	1013	060	180	-9.4	15.8	OFF		006/19
				CONT	P1					500ft/m
132838	18	FL050	1013	075	185	-0.1	-0.3	OFF		013/14
				END	P1					
133022	19	50ft	1018	060	190	12.9	7.6	OFF		357/13
				Hiway	Cal P	07				SS=3
				START	RUN 2					
134747	20	FL090	1013	280	180	-3.6	-21.2	OFF		358/16
							INTERESTING CHANGE IN DP		CC	HDG 03
				END	RUN 2					
140201	21	FL090	1013	280	180	-3.5	-34.1	OFF		006/18

Video Tape	
No.	A478H1
Ends	1539
FFC / DFC / RFC	

	GPS	INU
Lat	54 19.23N	54.187ON
Long	0°52.93E	00°47.70E
Time	135950	135940
Status	OK	NAV.

DRS recording to HORACE (y) n

HORACE recording to disc (y) n

SATCOM sending pos reports (y) n

1000 CFC

GMT	EVM	Height	QNH	Hdg	IAS	TAT	DP	DI Htr		Wind/ Sea st.
				Reciprocal		Run -				
		F		START RUN		3				
140328	22	FL090	1013	085	180	-3.4	-34.5	OFF		014/15
141116	Change	to DFC.								
					END	RUN 3				
142001	23	FL090	1013	085	180	-2.9	-2	OFF		040/13
					START	R4				
142227	24	FL120	1013	280	180	-6.2	-33.13	OFF		004/18.
142320		Vid Back	to FFC.							
					END	R4				
144001	25	FL120	1013	270	180	-4.2	-11.7	OFF		006/20
					START	R5	-9kts.			
144212	26	FL120	1013	295	250	-3.8	-10.4	OFF		005/21
					END	R5				
145713	27	FL120	1013	195	250	-3.1	-13.4	OFF		006/20
				TRANSIT	MONE					
152428				LAND	AZE.					
				HOLD		510488N				
						001	44 KG			
152901				DATA	OFF					

a Research Flight

VIDEO TAPE LOG

Flight No A 478

Project TACIT / ACSOE Date 13 09 96

Tape No AH78 #1 User CHEMISTRY Retention Period INDEF

GMT	Tape Counter	Camera Position	Remarks
1239	0000	FFC	Started Tape In climb Out-
1255 33 131553		FFC	RUN 1 FL 150
131845 133822		"	PROF 1 FL150 -> SURF
134747 140201		"	RUN 2 FL090
140329 142001		FFC DFC @ 141116	RUN 3 FL090
142227 144001		DFC FFC @ 142320	RUN 4 FL120
144212 145713		FFC	RUN 5 FL120
1524			LAND @ BOOMBIE
1529			TAPE OFF

Met Research Flight

CLOUD PHYSICS LOG

Flight No. A478 Date: 13/9/96 Operator: MP

G.M.T.	PCASP		FSSP			2D-C			HVPS / 2D-P			
DRS Time	Conc/cc	Mean R	Conc/cc	Max Size	RelT	Conc/L	Max Size	Habit	Conc/m³	Max Size	Habit	REMARKS
125533												Start Run 1 @ FL150
125900	20	0.08										
125800	18	0.09										
130000	14	0.09										
130200	10	0.09										
130400	8	0.08										
130600	10	0.08										
130800	10	0.09										
131000	20	0.08										
131200	23	0.09										
131400	23	0.08										
131534												
131545												End Run 1
131944	14	0.08										Start P1 from FL150
132042	17	0.08										FL140
132140	6	0.07										FL130
132242	30	0.08										FL120
132340	30	0.08										FL110
132440	60	0.09										FL100
132540	40	0.08										FL090
132646	30	0.08										FL080
132735	45	0.08										FL070
132835	85	0.10	0.07	5								FL060
133028	110	0.12										FL050
133221	130	0.11	0.7	10								4000'
133419	135	0.12	1	10								3000'
133552	140	0.13	0.7	5								2000'
133711	140	0.12	1	15								1000'
133826	180	0.12	1	20								500'
134747												End P @ 50'
134800	14	0.09										Start Run 2 @ FL090
135000	20	0.09										
135200	35	0.09										
135400	45	0.09										
135600	45	0.09										
135800	45	0.09										

CLOUD PHYSICS LOG

Flight No. A478 Date: 13/9/96 Operator: MP

G.M.T.	PCASP		FSSP			2D-C			HVPS / 2D-P			REMARKS
DRS Time	Conc/cc	Mean R	Conc/cc	Max Size	Reff	Conc/L	Max Size	Habit	Conc/m³	Max Size	Habit	
140000	50	0.09										
140200												end of Run 4
140332												Start Run 3 @ FL040
140400	60	0.09										
140600	65	009										
140800	50	0.09										
141000	50	0.08										
141200	45	0.08										
141400	40	0.09										
141600	35	009										
141800	14	009										
142004												end of Run 3
142227												Start Run 4 @ FL120
142300	50	009										
142500	50	0.09										
142700	50	0.09										
142900	40	0.09										
143100	35	008										
143300	33	008										
143500	11	008										
143700	12	008										
143900	13	008										
143954												end of Run 4
144313												Start Run 5 @ FL120
144300	8	0.08										
144500	9	008										
144700	5	008										
144900	10	0.08										
145100	5	0.08										
145300	7	0.08										
145500	5	0.08										
145700	3	0.09										
145913												end of Run 5

INS & OMEGA STATUS FORM

FLIGHT DATE 13/9/96 FTI MRF TACIA FLT No A _____

NAVIGATOR HEATON

PRE FLIGHT "RAMP AND PLATFORM" POSITION LAT N51098 LONG W001446

INS. TIME "NAV" SELECTED. 1220 GMT

POST FLIGHT "PLATFORM" POSITION LAT _____ LONG _____

POST FLIGHT "RAMP" POSITION LAT N51098 LONG W001446

TIME 1530 GMT. INS TOTAL RUNNING TIME = 3 Hrs 10 Mins.

3·2

CALCULATE RADIAL ERROR RATE (RER) AS FOLLOWS:-

1. ENTER POST FLIGHT "PLATFORM" POSITION INTO "PP2".
   (No need if INS not updated since switch on.)
2. SELECT "D1" ON THE DISPLAY SELECTOR AND ENTER LAT/LONG OF "RAMP" POSITON. ✓
3. SET DESTINATION SWITCH TO "D1" AND SELECT "CMDTRK/DIST" ON THE DISPLAY SELECTOR.
4. RECORD TOTAL ERROR READ-OUT = 3266 DEG x 6·2 NMLS
4. CALCULATE "RER" BY DIVIDING "DIST" READ OUT FROM CDU BY THE INS TOTAL RUNNING TIME.
5. RADIAL ERROR RATE = 326 DEG x 1·0 NMLS/HR. ENTER "RER" IN LOG BOOK.

INSPECT ADDRESSES:- SELECT "I" THEN "70840 ENT" 68W

"70841 ENT" SE

"70848 ENT" 1E

CARRY OUT GYRO DRIFT RATE AS FOLLOWS:-

1. SET DISPLAY SELECTOR TO "PP". ✓
2. PRESS "FIX" BUTTON (Status Indicator = 9). ✓
3. INSERT "RAMP" POSITION LAT N51098 LONG W001446
   (Press "ENT" after LAT entered and again after LONG entered)
4. SET MODE SELECTOR TO "ALN". (Status Indicator = 5). ✓
5. SET DISPLAY SELECTOR TO "G". (Y=upper & Z=lower drifts displayed).
6. PRESS "FIX". UPDATED VALUES OF Y AND Z GYRO DRIFTS DISPLAYED.
   (note. X Gyro Drift is not modified.)
7. RECORD NEW VALUES Y 0015 Z 0001W TIME SWITCH OFF 1533 GMT.

OMEGA FINISH POSITION LAT N51097 LONG W001462

DISK: PROFORMA/INSFORM

FLT LOG

INPUT WEIGHT & FUEL SUMMARY — Computed for Met Research Flight by C F P

Max TOW	= 155000 lbs	Max LW	= 135000 lbs
ZFW	= 96000 lbs		
Ramp Fuel	= 33000 lbs		
Start/Taxy	= 1000 lbs		
Diversion	= 1000 lbs		
Overhead	= 5500 lbs		
Hold FF	= 4500 lbs		
Contingency	= 5 %		
Extra Fuel	= 0 lbs		

Hercules-W2 MEAN Computed

Weather

Dep: EGDM Elev:00407'	Des: EGDM Elev:00407'
R/W:____OAT:_____QNH :_____	R/W:____OAT:_____QNH :_____
W/V:_____ QFE :_____	W/V:_____ QFE :_____
Wx :_____SALT:_____	Wx :_____SALT:_____
Cloud:	Cloud:

From EGDM To EGDM C/S Crew Date 13 09 96

ATC

WPT	Lvl	W/V	ISA	TkT	TkM	Dr	TAS	GrS	DIS	EET	ETA	ATA	TET	FU	Rmg	FF(k)	DTG
EGDM															32000		598
10ML05	ASC	001/20	+5	230	234	-5	180	192	11	3			0.03	400	31600	8.0	587
FFA	30	001/20	+5	009	014	+1	250	230	39	10			0.13	1119	30481	6.6	548
DTYW	60	001/40	+5	071	076	+9	240	223	53	14			0.27	1426	29055	6.0	495
DTYE	100	001/40	+5	358	002	-0	305	265	25	6			0.33	642	28413	6.8	470
WIT	120	001/40	+5	351	355	-2	260	221	14	4			0.37	380	28033	6.0	456
54N0##	150	001/47	+4	004	008	+0	310	263	84	19			0.56	2124	25909	6.7	372
STRUN1	70	001/27	+4	075	079	+7	220	211	84	24			1.20	1991	23918	5.0	288
ENRUN1	50	001/27	+5	267	270	-8	190	190	70	22			1.42	1879	22039	5.1	218
LOITER	.	. . .	.	.	.	.	.	.	.	40			2.22	3333	18706	5.0	218
GAM	80	001/36	+5	210	215	-5	210	241	67	17			2.39	1529	17177	5.5	151
DTYE	140	001/36	+5	161	166	+2	313	347	57	10			2.49	1068	16109	6.5	94
DTYW	100	001/36	+5	182	186	-0	308	344	25	4			2.53	494	15615	6.8	69
EGDM	50	001/20	+5	226	230	-4	210	224	69	22			3.15	1694	13921	5.5	0
Diversion							Totals		598	191							
EGDL	50	C-30	+5	336	340	+0	210	180	23	8			3.19	703	13218	5.5	0

FUEL SUMMARY	lbs			WEIGHT SUMMARY	lbs
Start/Taxy	: 1000	T/O Fuel	: 32000		
Plan Fuel	: 18079	Plan Fuel	: 18079		
Diversion	: 1000	Actual Reserve	: 13921	ZFW	: 96000
Min Overhead	: 5500	Hold Fuel Flow	: 4500	Ramp Fuel	: 33000
Contingency	: 904	Rsv Endurance	: 3.05	Ramp Weight	: 129000
Extra Fuel	: 0	Flt Plan Time	: 3.11	Take Off Weight	: 128000
Reqd Start Fuel	: 26483	Total Endurance	: 6.16	Landing Weight	: 109921

(c) RJCV 1991

WAYPOINTS

EGDM	00407'	N5109.5	W00144.3
10ML05		N5102.2	W00158.2
FFA	081X	N5140.9	W00147.8
DTYW	DTCORW	N5158.0	W00147.0
DTYE	DTCORE	N5223.0	W00026.0
WIT	123X	N5236.4	W00029.8
54N0##		N5400.0	W00020.0
STRUN1		N5420.0	E00200.0
ENRUN1	UK	N5415.0	W00000.0
GAM	112.80	N5316.9	W00056.7
DTYE	DTCORE	N5223.0	W00026.0
DTYW	DTCORW	N5158.0	W00147.0
EGDM	00407'	N5109.5	W00144.3
EGDL	00513'	N5130.6	W00159.4

OBSERVATIONS

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

DATE 13/9/96 TI MRF TAKA NAV HEATON

AIRFIELD Base Pool6 AIRFIELD Base Lo16

R/W 05 W/V 350/13 TEMP +20 QNH 1019 OFE 1004 R/W 05 W/V 080/14 TEMP +17 QNH 1019 OFE 1004

WX NIL WX NIL NO 24,000

ATC CL Base 6557 ATC CL BZ VM

T/O TIME 1230. LAND TIME

TIME	HDG	DR	G/S	IAS	TAS	W/V	ALT/FL	QNH/PR	LAT/LONG	RUN
1234	006								Base ↑ and FL80	—
1255:33	010	ϕ	250	233	300	011/45	FL150	1013 1992	N5224 W00 04.34	ST RUN 1
1315:55						000/40	FL150	✓	N53 50.3 W000 23.6	END RUN 1
1318:45	066	95	243	188	232	012/34	↓	1016.	N53 56.5 W000 06.78.	ST P1
1338:25	060					357/30	50'	1017.	N54 18.1 E001 16.6	END P1
✓								1013	↑ FL90.	
1348:46	272	90.	211	181	209	003/29	FL90.	1013	N54 21.8 E001 56.2	ST RUN 2
1402:00						007/32	✓	✓	N54 18.2 E000 32.1	END RUN 2
1410:26	088	95	196	180	205	016/29	90	✓	N54 20.3 E000 32.2	ST RUN 3
1426:00							90		N54 22.1 E002 08.3	END RUN 3
✓									↑ FL120	
1422:26	271	90.	223	180	220	003/35	FL120	1013	N54 23.7 E000 20.2	ST RUN 4
1440:00						009/40	FL120	✓	N54 12.7 E000 06.9	END RUN 4
1442:12	188	ϕ	360	258	315	007/40	FL120	✓	N54 29.7 W000 00.0	ST RUN 5
1457:12						008/40	✓		N52 37.7 W000 25.2	END RUN 5
									↘ FL100	
									↳ 20 462	
									↳ 10	
									Climb ↳ 3000	

E000 H001

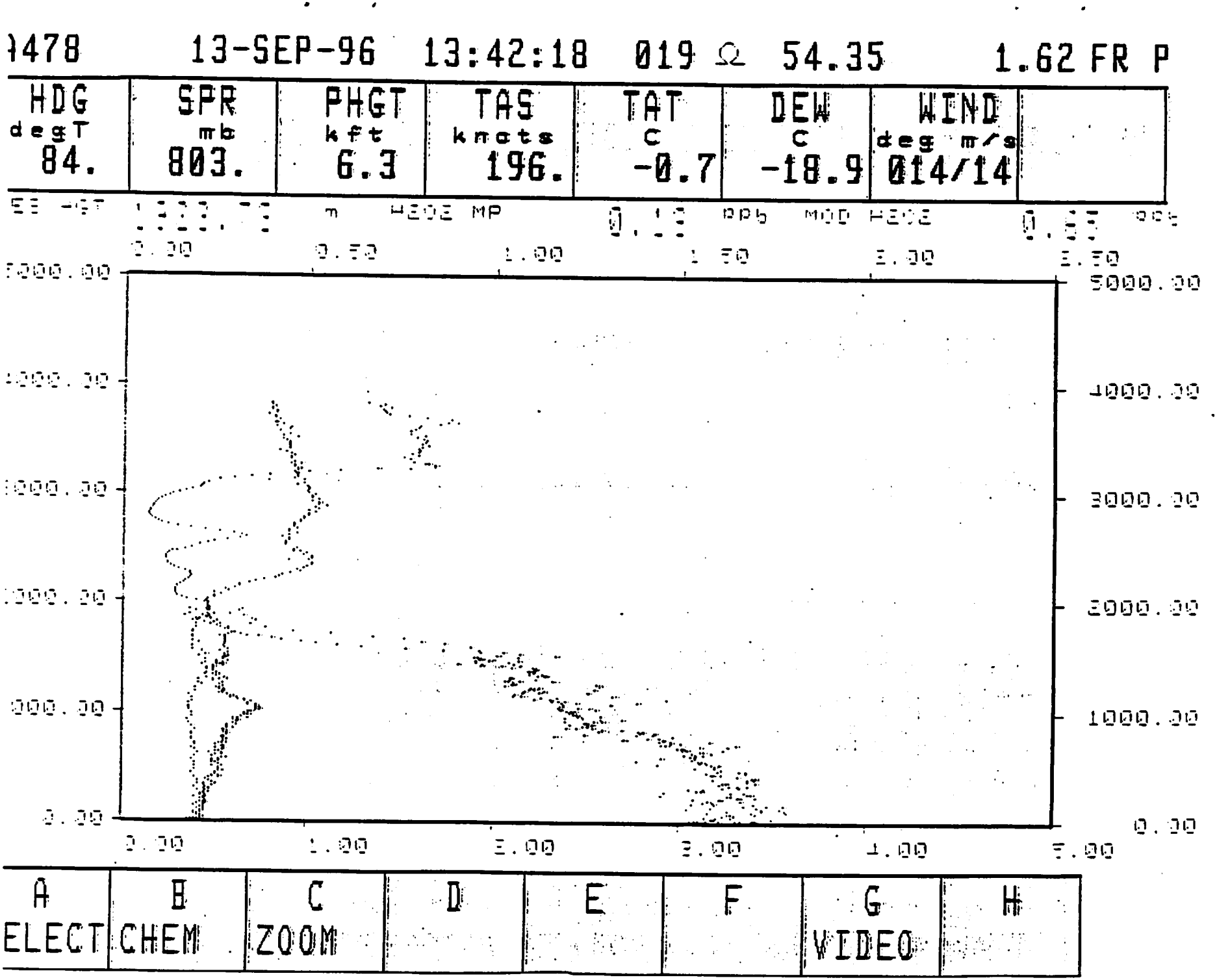
DISK PROFORMA/NAVFORM

FLIGHT LEADER'S INSTRUMENT STATUS REPORT

FLIGHT NO: AW78 DATE: 13 /09 / 96 MRF 13

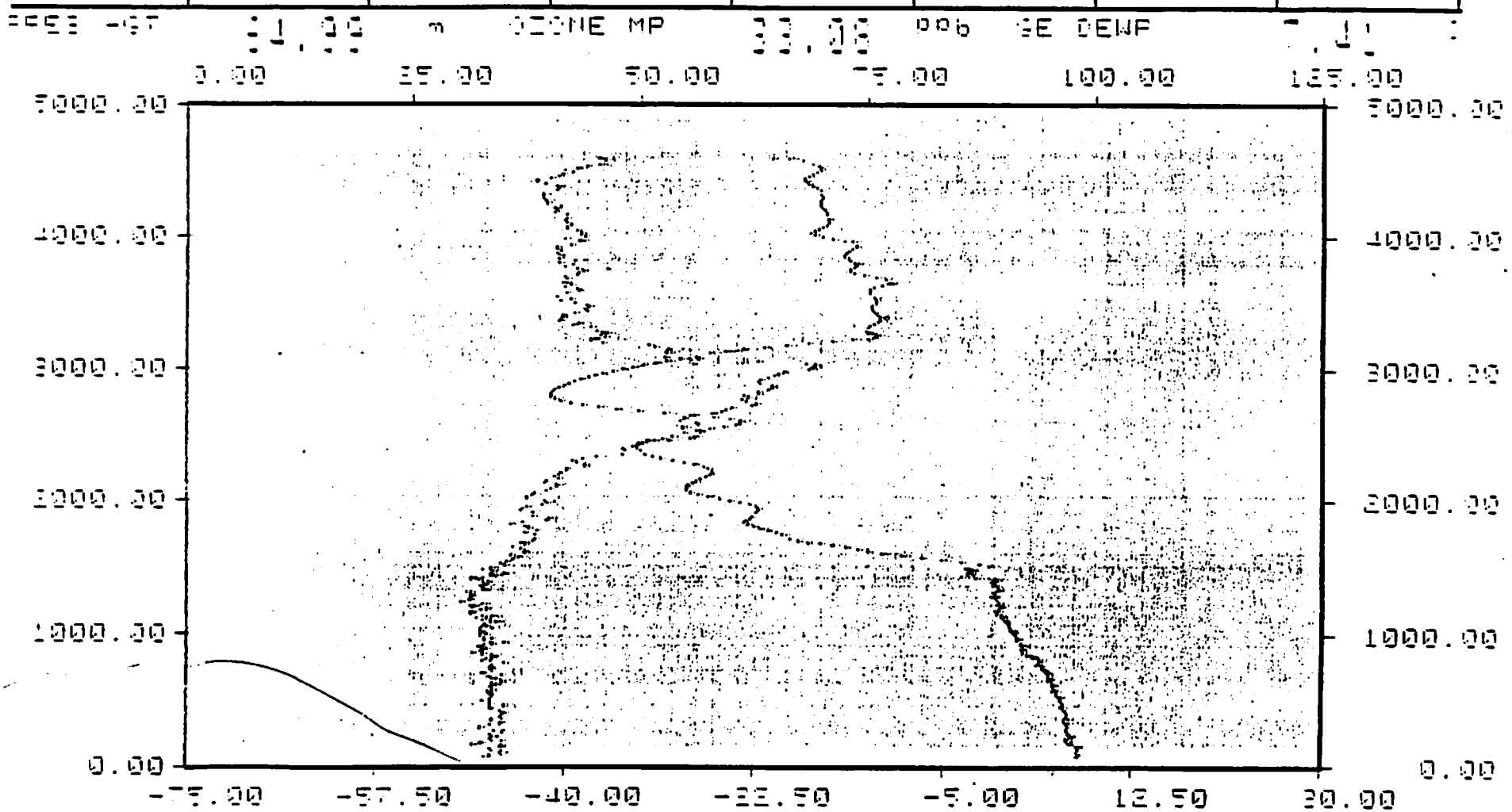
INSTRUMENT	FITTED	OPERATED	COMMENTS
NAVIGATION:			
GPS	/		
OMEGA	/		
INU	/		
RADALT	/		
THERMOMETERS:			
DI TEMP	/		
NDI TEMP	/		
ICTP	/		
HEIMANN	/		
HYGROMETERS:			
GEN. EASTERN	/		
TWC	/		
FWVS	/		
J/W	/		
EXP. PITOT HEAD:			
STATIC PRESS.	/		
PITOT PRESS.	/		
GUST VANES	/		
RADIOMETERS:			
UPPER CLEAR	/		
UPPER RED	/		
UPPER SILICON	3N02		
LOWER CLEAR	/		
LOWER RED	/		
LOWER SILICON	3N02		
MARSS	/		
SAFIRE	/		
DEIMOS	/		
ARIES	/		
CHEMISTRY:			
OZONE	/		
ECGC	/		
NOX Y	/		
OTHERS:			
CCN	/		
CLOUD PHYSICS	/		
CABIN PRESS	/		
NEPHELOMETER	/		
PSAP	/		

P.T.O. FAULTS/INCIDENTS


1478 13-SEP-96 13:42:18 019 Ω 54.35 1.62 FR P
HDG degT 84.
SPR mb 803.
PHGT kft 6.3
TAS knots 196.
TAT C -0.7
DEW C -18.9
WIND deg m/s 014/14
0.00
0.50
1.00
1.50
2.00
2.50
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
A ELECT
B CHEM
C ZOOM
D
E
F
G VIDEO
H

A478 13-SEP-96 13:37:33 018 Ω 54.30 1.23 FR P

HDG degT	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s	
59.	1005.	0.2	184.	11.9	7.4	355/16	



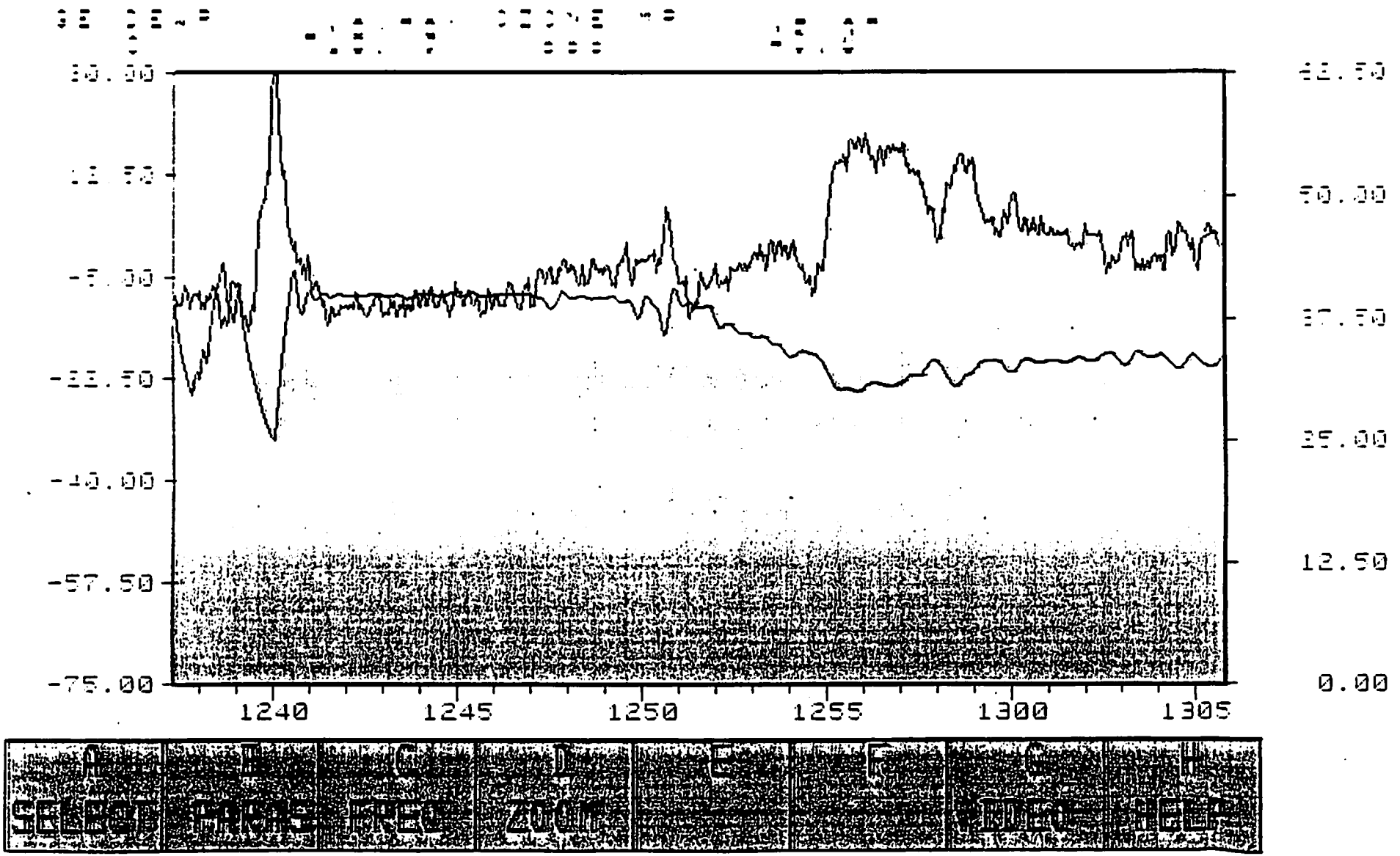
A	B	C	D	E	F	G	H
SELECT	CHEM	ZOOM				VIDEO	

A478 13-SEP-96 13:21:09 017 ◇ 54.02 -0.05 FR P

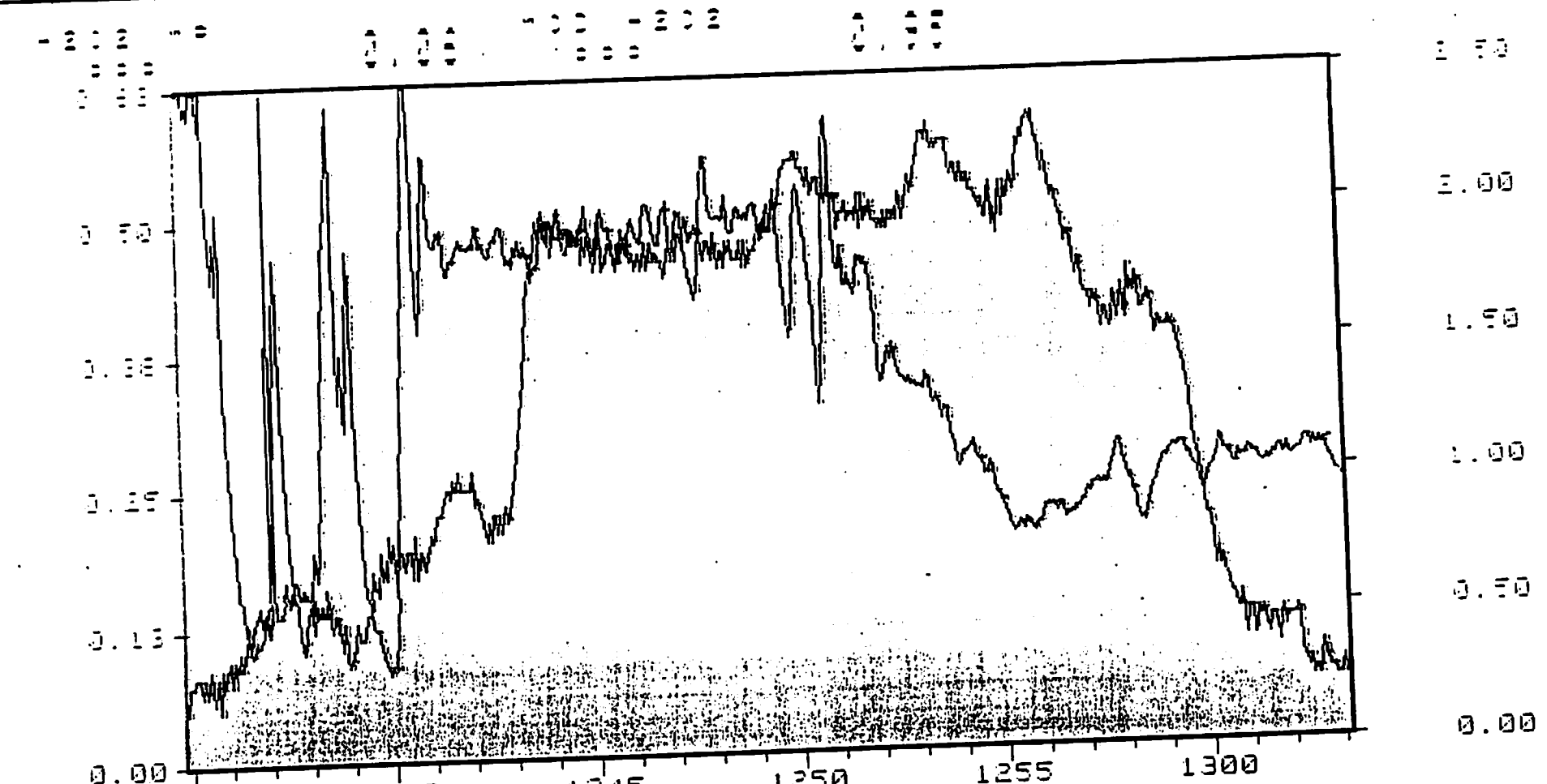
HDG deg T	SPD mph	PHGT kft	TAS knots	TAT C	DEW C	WIND deg/kt
56.	631.	12.5	224.	-4.4	-13.5	016/21

SELECT A	PARAMS B	FREQ C	ZOOM D	E	F	VIDEO G	HELP H

HDG degT	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s
11.	570.	15.1	311.	-9.1	-18.8	009/21



HDG degT	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s
11.	571.	15.1	311.	-9.0	-20.5	010/21



A SELECT | B BARBS | C FREQ | D ZOOM | E | F | G RATIO | H HEAD

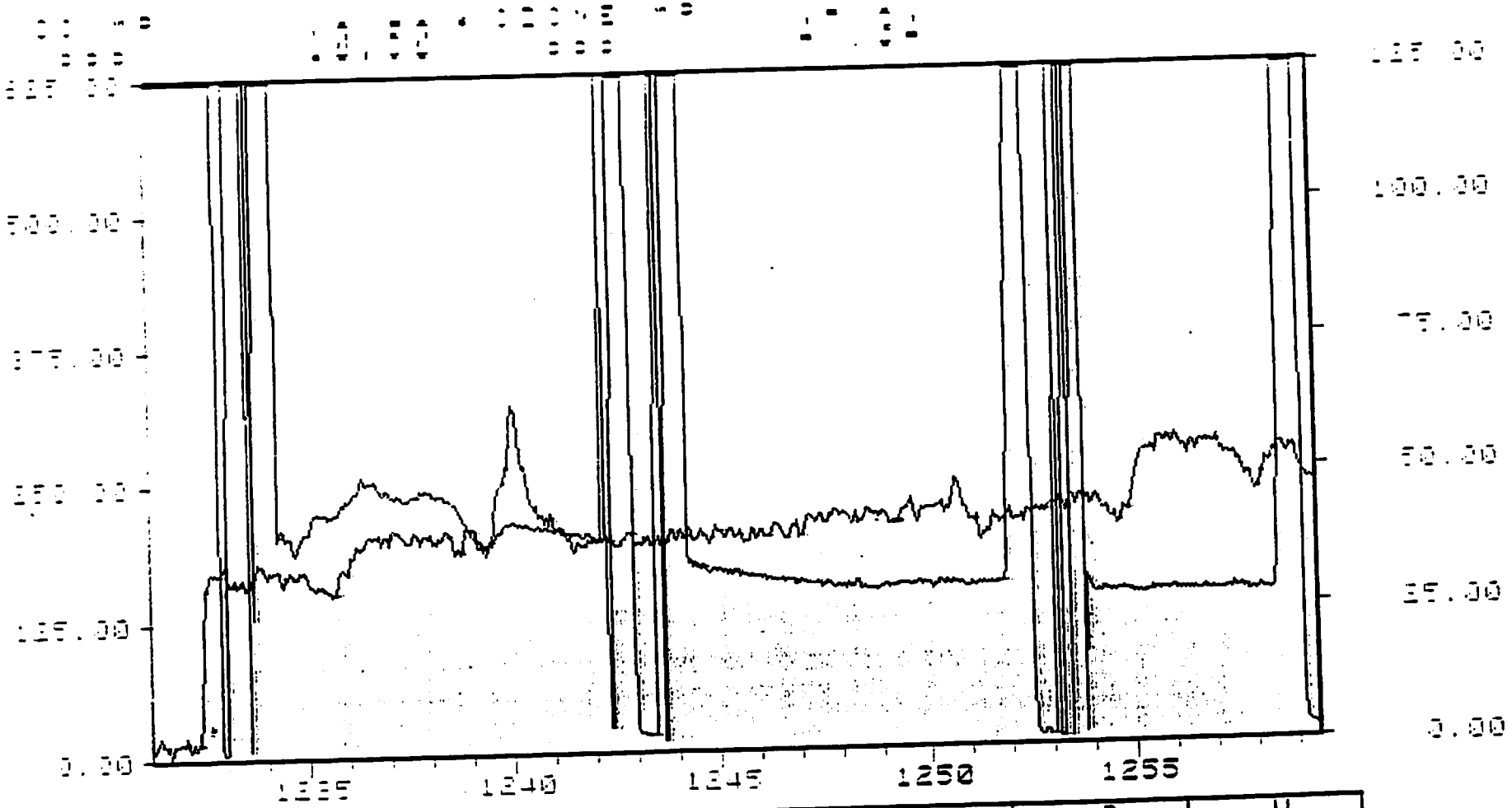
A478 13-SEP-96 14:49:18 020 -- 03.00 -0.01

HDG deg T	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s
193.	646.	12.0	311.	-4.1	-10.1	008/22

A (EJECT)	B (PARAS)	C (FREQ)	D (ZOOM)	E	F	G (VIDEO)	H (HELP)

A478 13-SEP-96 12:59:24 015 52.68

HDG deg T	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s
10.	570.	15.1	312.	-9.0	-19.4	012/22



A	B	C	D	E	F	G	H
SELECT	PARAS	FREQ	ZOOM			VIDEO	HELP

A478 13-SEP-96 13:01:09 015 52.80 -0.61 FR P

HDG deg T	SPR mm	PHGT kft	TAS knots	TAT C	DEW C	WIND deg/kts
11.	570.	15.1	312.	-6.0	-19.5	012/22

SELECT	PARAS	FREQ	ZOOM				
A	B	C	D	E	F	G	H

| | | | |

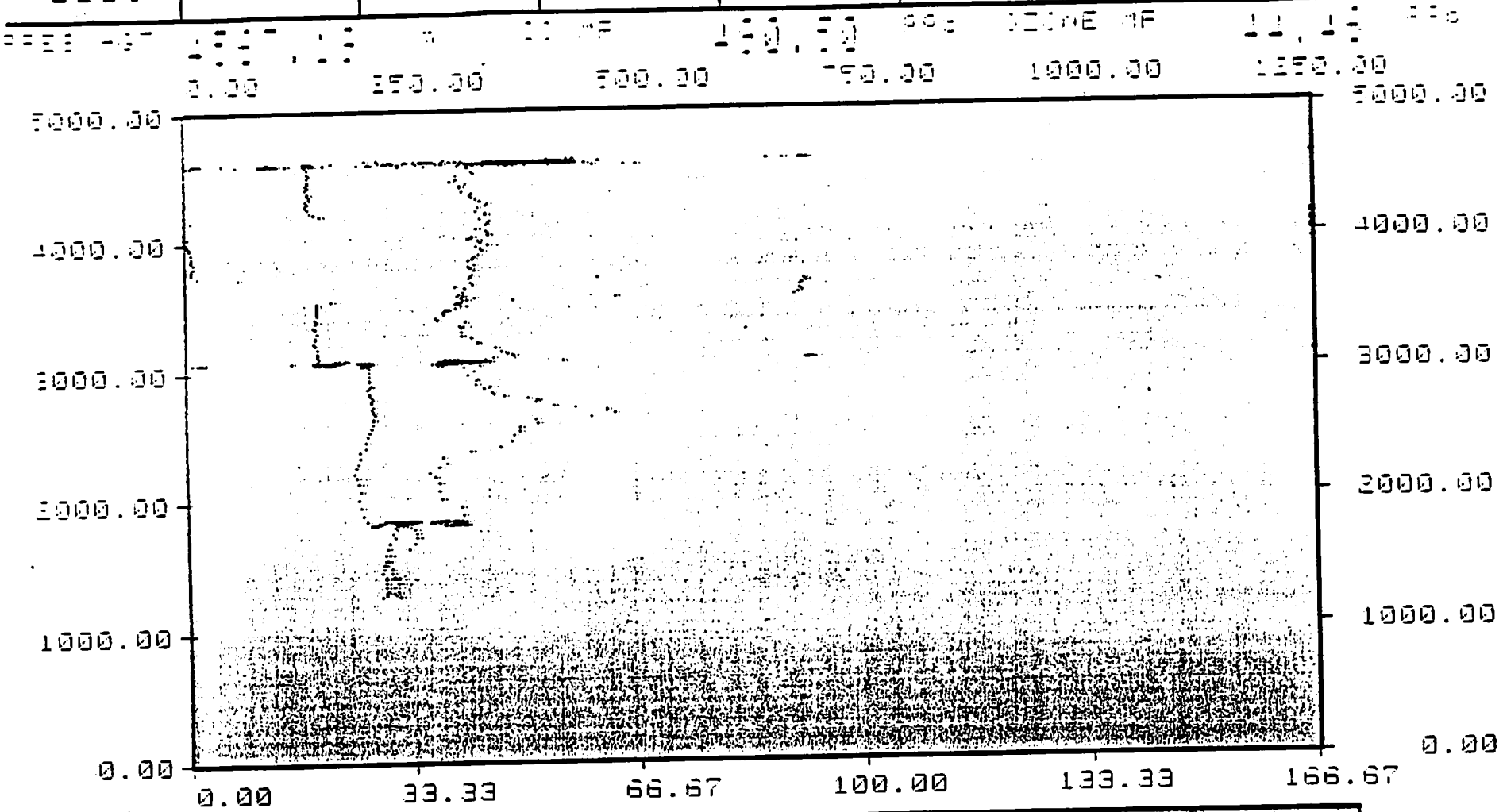
A478 13-SEP-96 13:08:48 015 ♡ 53.37 -0.45 FR P

HDG deg	SPR mm	PHGT kft	TAS knots	TAT C	DEM C	WIND deg/kt
7.	570.	15.1	310.	-9.5	-18.2	009/21

SELECT A	PARAMS B	FREQ C	ZOOM D	E	F	VIDEO G	HELP H

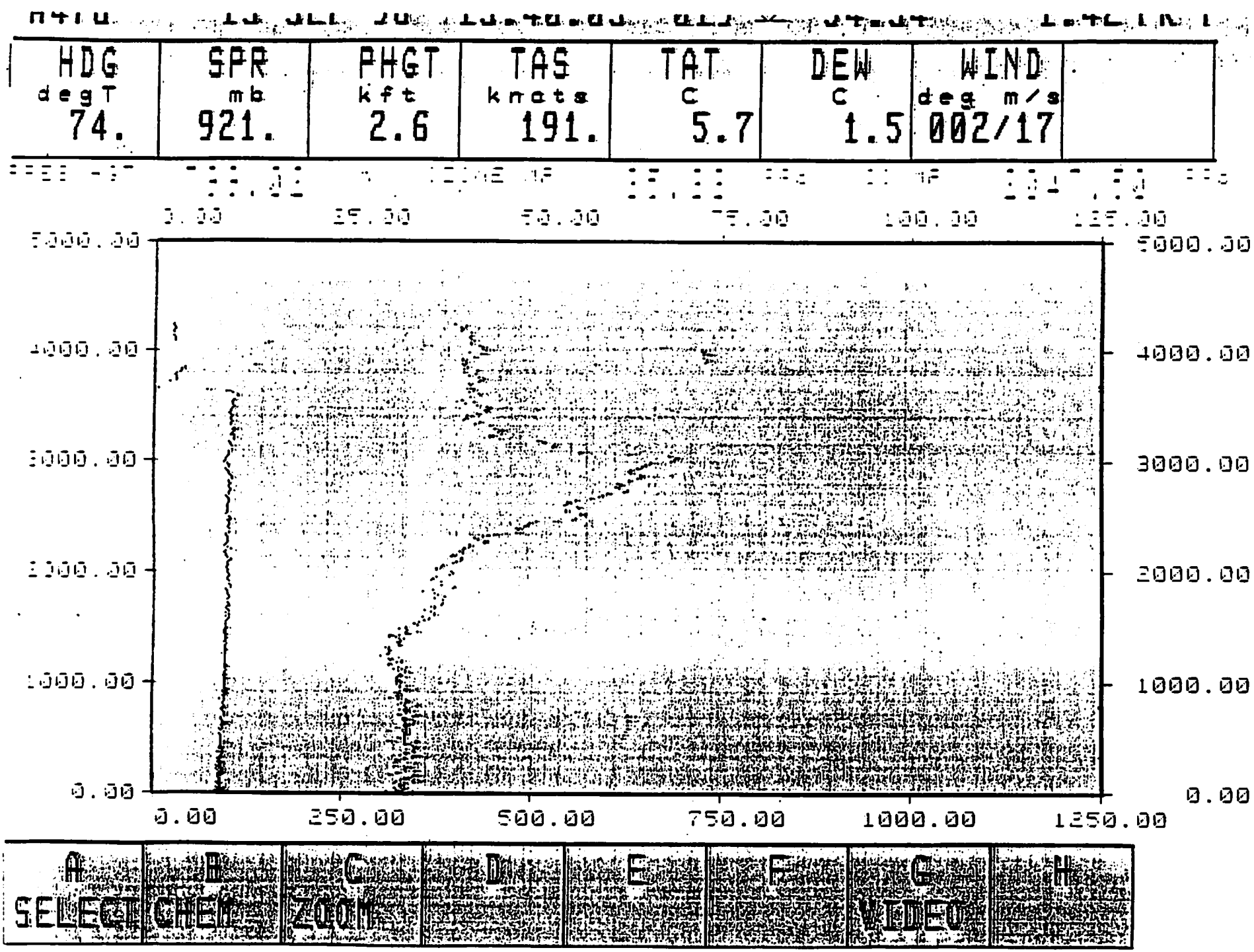
H41 0

HDG degT	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s	
359.	572.	15.0	237.	-9.5	-17.7	004/20	



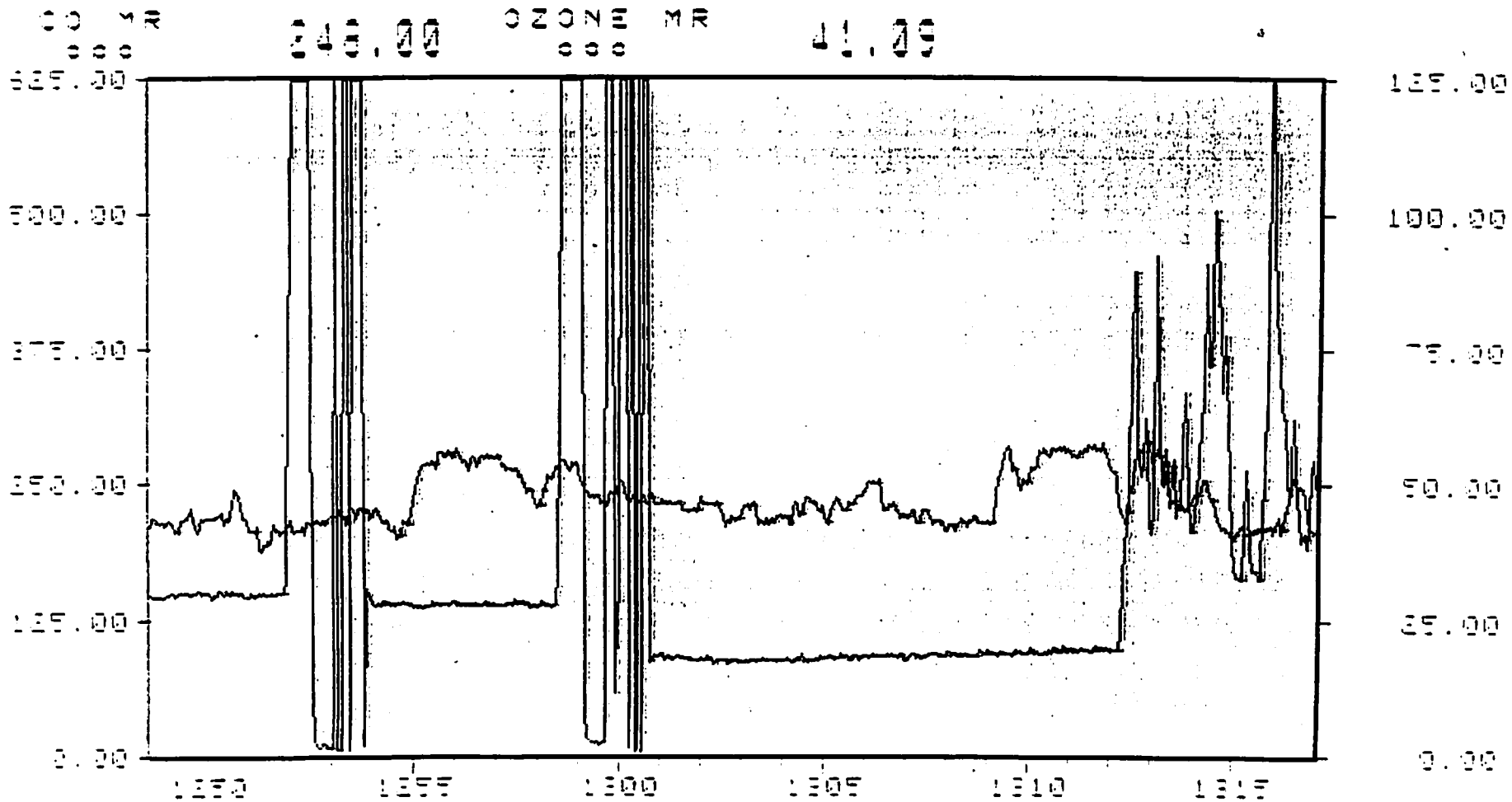
A SELECT CHEM | B ZOOM | C | D | E | F | G WIDE | H

A478 13-SEP-96 13:46:33 019 ↻ 54.34 2.04 FR
HDG deg T 38.
SPR mb 723.
PHGT kft 9.0
TAS knots 210.
TAT C -3.4
DEW C -16.2
WIND deg m/s 002/16
SELECT A
CHEM B
ZOOM C
D
E
F
VIDEO G
H


HDG
degT
74.
SPR
mb
921.
PHGT
kft
2.6
TAS
knots
191.
TAT
C
5.7
DEW
C
1.5
WIND
deg m/s
002/17
0.00
250.00
500.00
750.00
1000.00
1250.00
0.00
1000.00
2000.00
3000.00
4000.00
5000.00
A
SELECT
B
CHEM
C
ZOOM
D
E
F
G
VIDEO
H

A478 13-SEP-96 13:16:48 016 Ω 53.88 -0.39 FR P

HDG degT	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s
359.	571.	15.0	230.	-9.7	-16.4	000/19

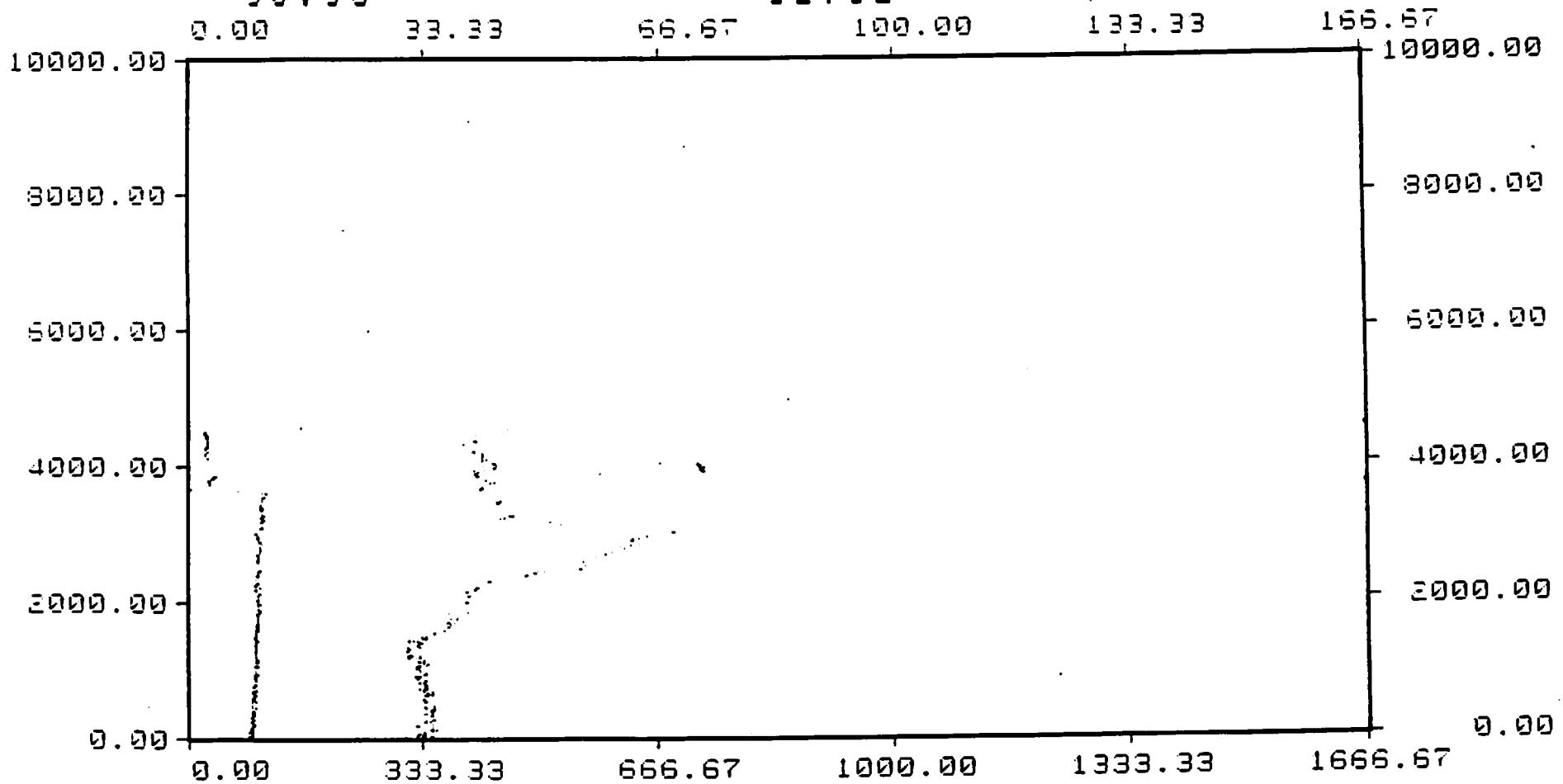


A	B	C	D	E	F	G	H
SELECT	PARAS	FREQ	ZOOM			VIDEO	HELP

A478 13-SEP-96 13:38:42 019 54.32 1.31 AS P

HDG degT	SPR mb	PHGT kft	TAS knots	TAT C	DEW C	WIND deg m/s	
53.	1002.	0.3	182.	11.8	7.5	358/15	

PRES HGT 95.98 m OZONE MR 32.62 ppb CO MR 91.00 ppb



A	B	C	D	E	F	G	H
CCI CCT	CUCM	7000M				VIDEO	

FSXX 00Z 14 SEPT.

METEOROLOGICAL OFFICE FAX F 28

FSXX EGRR 24H MSLP FORECAST VT 0000 UTC 14 SEP 1996

Polar Stereographic Projection. Standard Parallel 60°N. Original [illegible]

PAGE.001

13 SEP '96 04:06 FROM MET IT OPS BRACKNELL TO 4806

** TOTAL PAGE.001 **

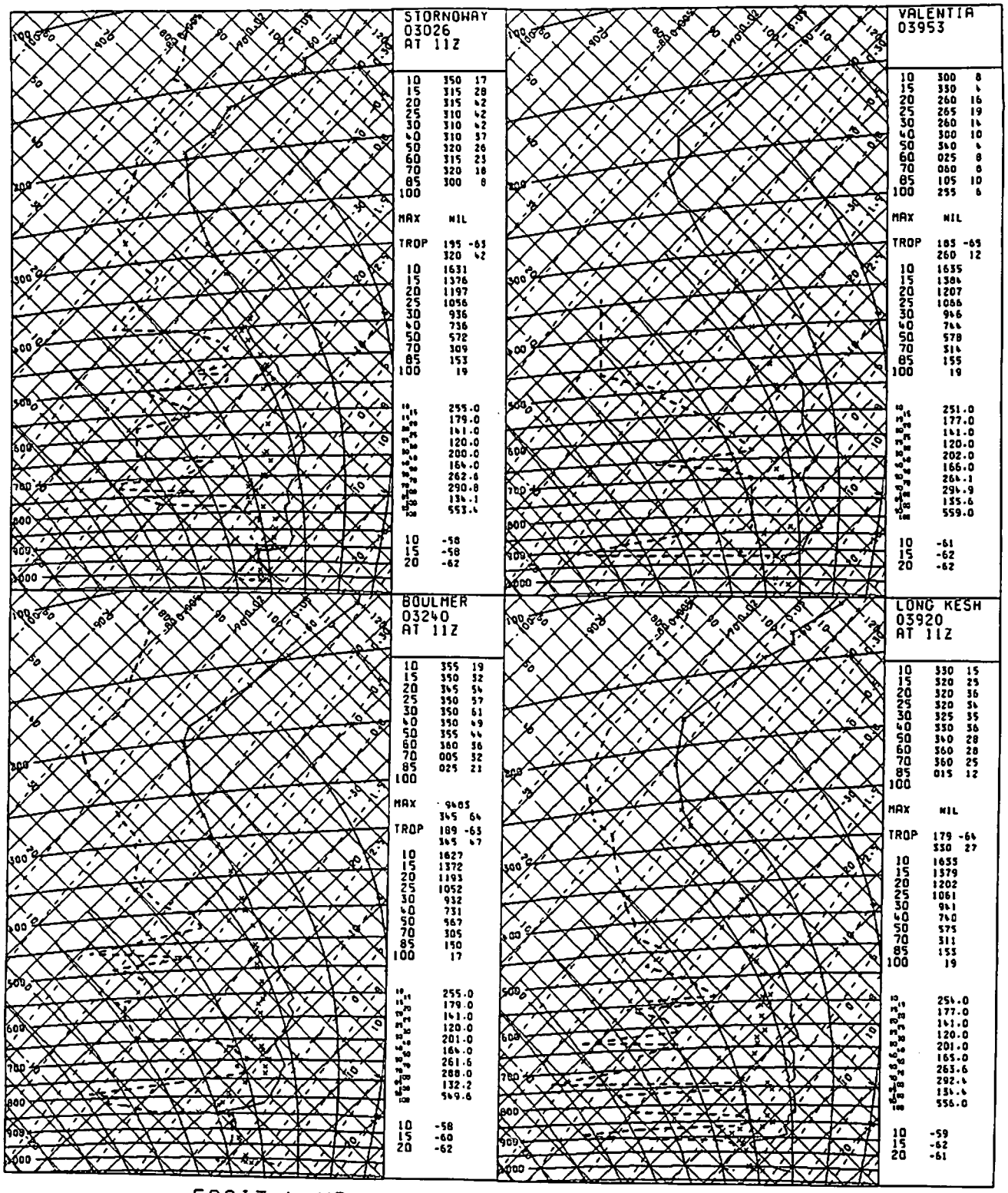
13 SEP '96 04:21

GEOSTROPHIC WIND SCALE
IN KNOTS FOR 4 MB INTERVALS

SCALE OF NAUTICAL MILES

NUM PROBABILITY AT MSL
OTAL PPN RATE
RESSURE AT MSL
DT 12Z FRIDAY 13/9/1996 LMAIN
SNOW
CONVECTIVE
DYNAMIC
.03 .1 .5 1.0 MM/HR AT VT
T+6 VT 18Z FRIDA 13/9/1996
T+12 VT 0Z SATURDAY 14/9/1996
T+18 VT 6Z SATURDAY 14/9/1996
T+24 VT 12Z SATURDAY 14/9/1996
T+30 VT 18Z SATURDAY 14/9/1996
T+36 VT 0Z SUNDAY 15/9/1996

OTAL ACCUMULATION
850MB WET BULB POT TEMP DT 12Z FRIDAY 13/9/1996 LMAIN
RAINFALL IN MM DURING THE 6 HOURS ENDING AT VT
T+6 VT 18Z FRIDAY 13/9/1996
T+12 VT 0Z SATURDAY 14/9/1996
T+18 VT 6Z SATURDAY 14/9/1996
T+24 VT 12Z SATURDAY 14/9/1996
T+30 VT 18Z SATURDAY 14/9/1996
T+36 VT 0Z SUNDAY 15/9/1996



STORNOWAY
03026
AT 11Z

10	350	17
15	345	28
20	345	42
25	340	42
30	340	42
40	340	37
50	320	26
60	315	23
70	320	18
85	300	8
100		

MAX NIL

TROP	195	-63
	320	42

10	1631
15	1376
20	1197
25	1056
30	936
40	736
50	572
70	309
85	153
100	19

	255.0
	179.0
	141.0
	120.0
	200.0
	164.0
	262.6
	290.8
	134.1
	553.4

10	-58
15	-58
20	-62

VALENTIA
03953

10	300	8
15	330	4
20	260	16
25	265	19
30	260	14
40	300	10
50	340	4
60	025	8
70	080	8
85	105	10
100	255	6

MAX NIL

TROP	185	-65
	260	12

10	1635
15	1384
20	1207
25	1066
30	946
40	744
50	578
70	314
85	155
100	19

	251.0
	177.0
	141.0
	120.0
	202.0
	166.0
	264.1
	296.9
	135.6
	559.0

10	-61
15	-62
20	-62

BOULMER
03240
AT 11Z

10	355	19
15	350	32
20	345	54
25	350	57
30	350	61
40	350	49
50	355	44
60	360	36
70	005	32
85	025	21
100		

MAX 9485

	345	64
TROP	189	-63
	345	47

10	1627
15	1372
20	1193
25	1052
30	932
40	731
50	567
70	305
85	150
100	17

	255.0
	179.0
	141.0
	120.0
	201.0
	164.0
	261.6
	288.0
	132.2
	549.6

10	-58
15	-60
20	-62

LONG KESH
03920
AT 11Z

10	330	15
15	320	25
20	320	36
25	320	34
30	325	35
40	330	36
50	340	28
60	360	28
70	360	25
85	015	12
100		

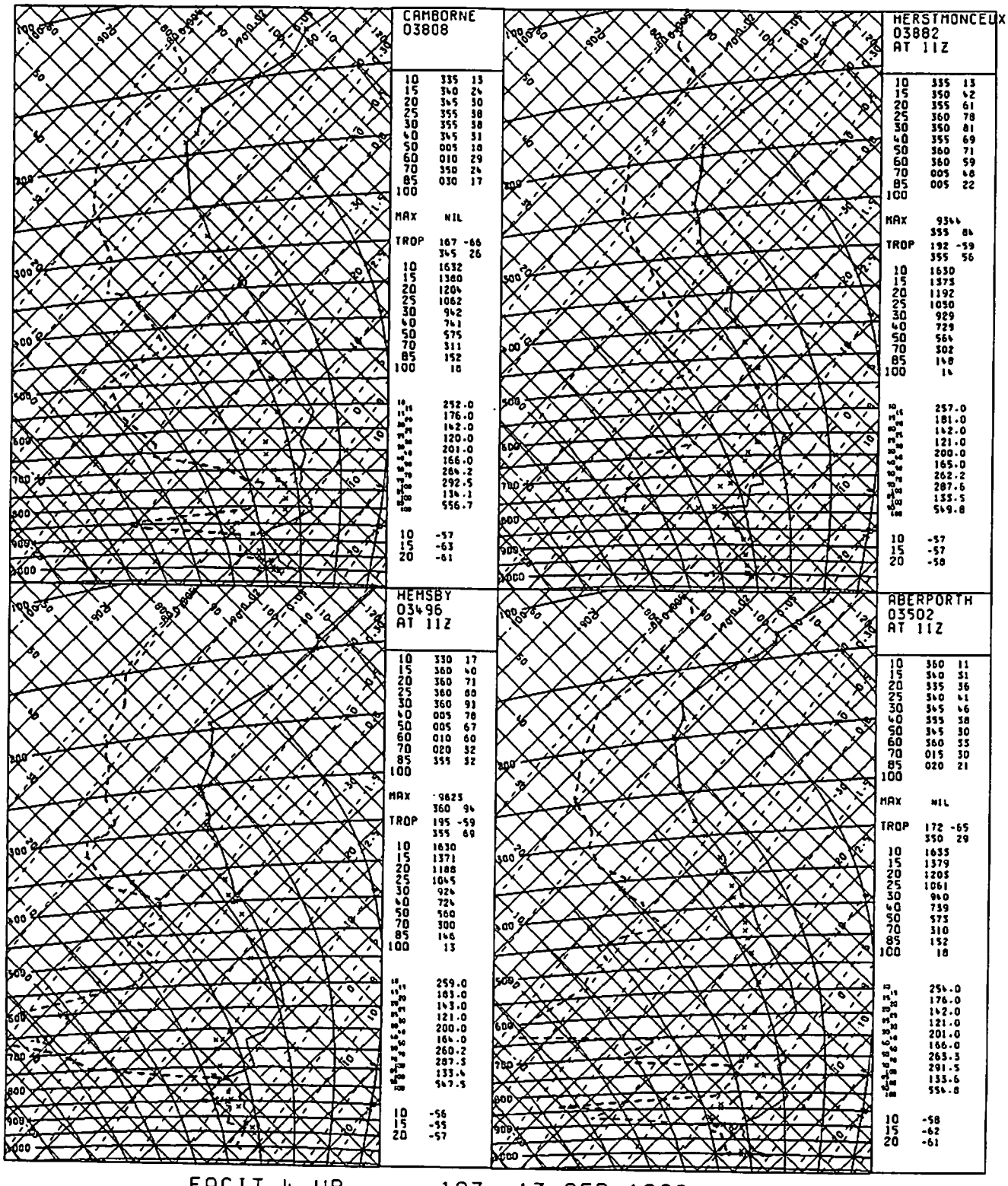
MAX NIL

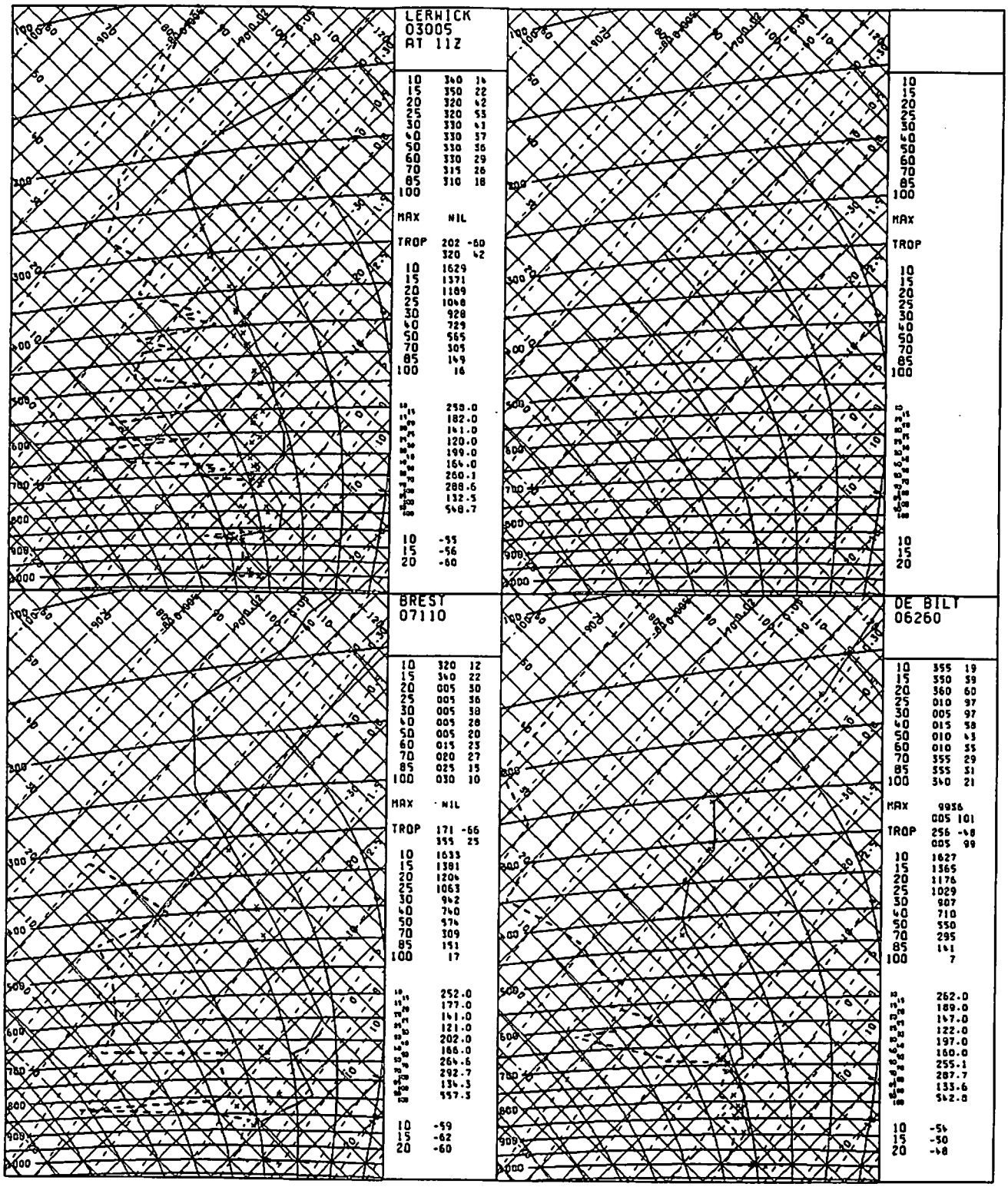
TROP	179	-64
	330	27

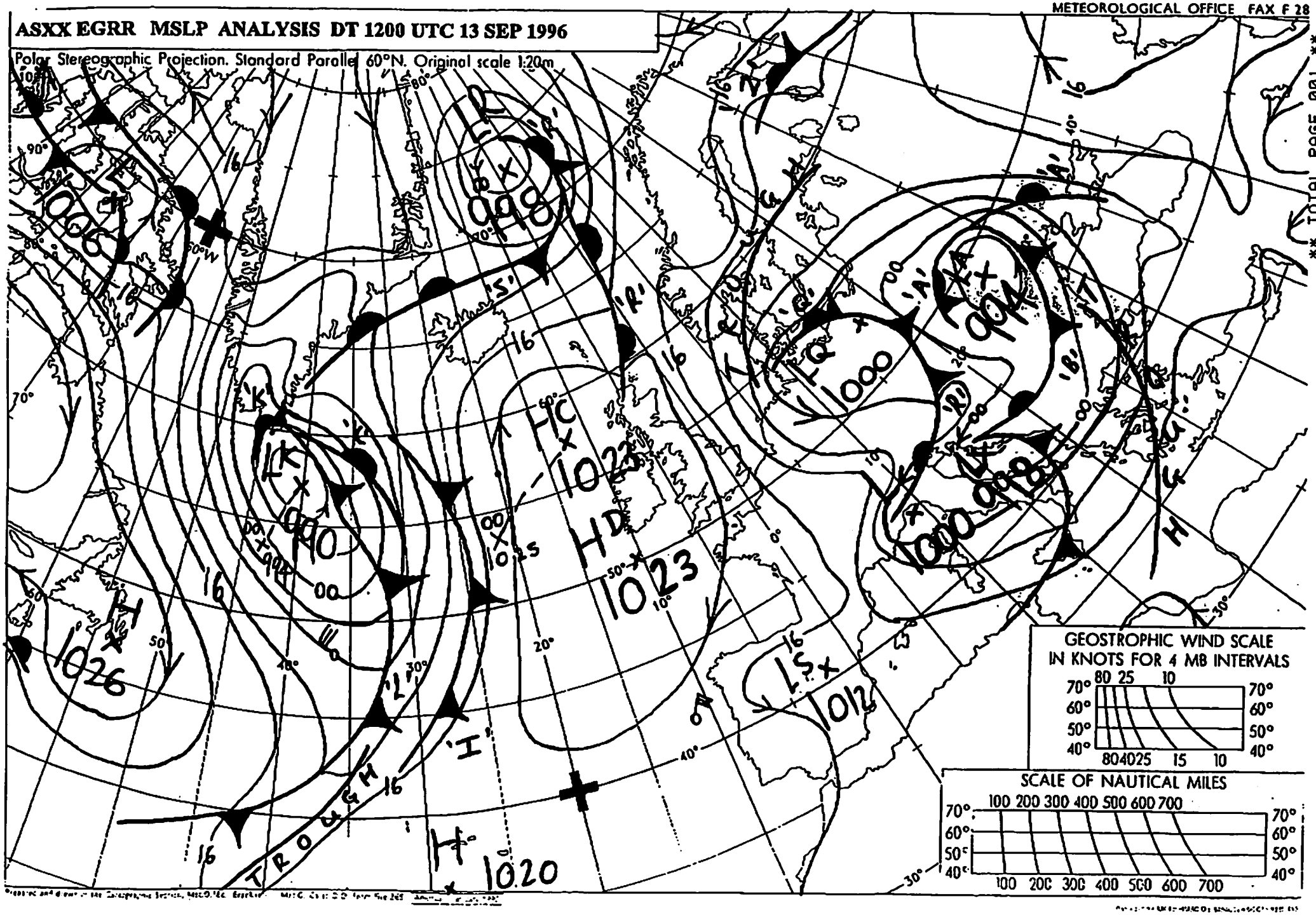
10	1635
15	1379
20	1202
25	1061
30	941
40	740
50	575
70	311
85	153
100	19

	254.0
	177.0
	141.0
	120.0
	201.0
	165.0
	263.6
	292.4
	134.4
	556.0

10	-59
15	-62
20	-61


CAMBORNE
03808
10 335 13
15 340 24
20 345 30
25 355 38
30 355 38
40 345 31
50 005 18
60 010 29
70 350 24
85 030 17
100
MAX NIL
TROP 167 -66
345 26
10 1632
15 1380
20 1204
25 1062
30 942
40 761
50 575
70 311
85 152
100 18
252.0
176.0
142.0
120.0
201.0
166.0
264.2
292.5
134.1
556.7
10 -57
15 -63
20 -61
HERSTMONCEUX
03882
AT 11Z
10 335 15
15 350 42
20 355 61
25 360 78
30 350 81
40 355 69
50 360 71
60 360 59
70 005 48
85 005 22
100
MAX 9344
355 84
TROP 192 -59
355 56
10 1630
15 1373
20 1192
25 1050
30 929
40 729
50 564
70 302
85 148
100 14
257.0
181.0
142.0
121.0
200.0
165.0
262.2
287.6
133.5
549.8
10 -57
15 -57
20 -58
HEMSBY
03496
AT 11Z
10 330 17
15 360 40
20 360 71
25 360 88
30 360 93
40 005 78
50 005 67
60 010 60
70 020 32
85 355 32
100
MAX 9825
360 94
TROP 195 -59
355 69
10 1630
15 1371
20 1188
25 1045
30 924
40 724
50 560
70 300
85 146
100 13
259.0
183.0
143.0
121.0
200.0
164.0
260.2
287.3
133.4
547.5
10 -56
15 -55
20 -57
ABERPORTH
03502
AT 11Z
10 360 11
15 340 51
20 335 36
25 340 41
30 345 46
40 355 38
50 345 30
60 360 35
70 015 30
85 020 21
100
MAX NIL
TROP 172 -65
350 29
10 1635
15 1379
20 1205
25 1061
30 940
40 739
50 573
70 310
85 152
100 18
254.0
176.0
142.0
121.0
201.0
166.0
263.3
291.5
133.6
554.8
10 -58
15 -62
20 -61


LERWICK
03005
AT 11Z
BRESY
07110
DE BILT
06260

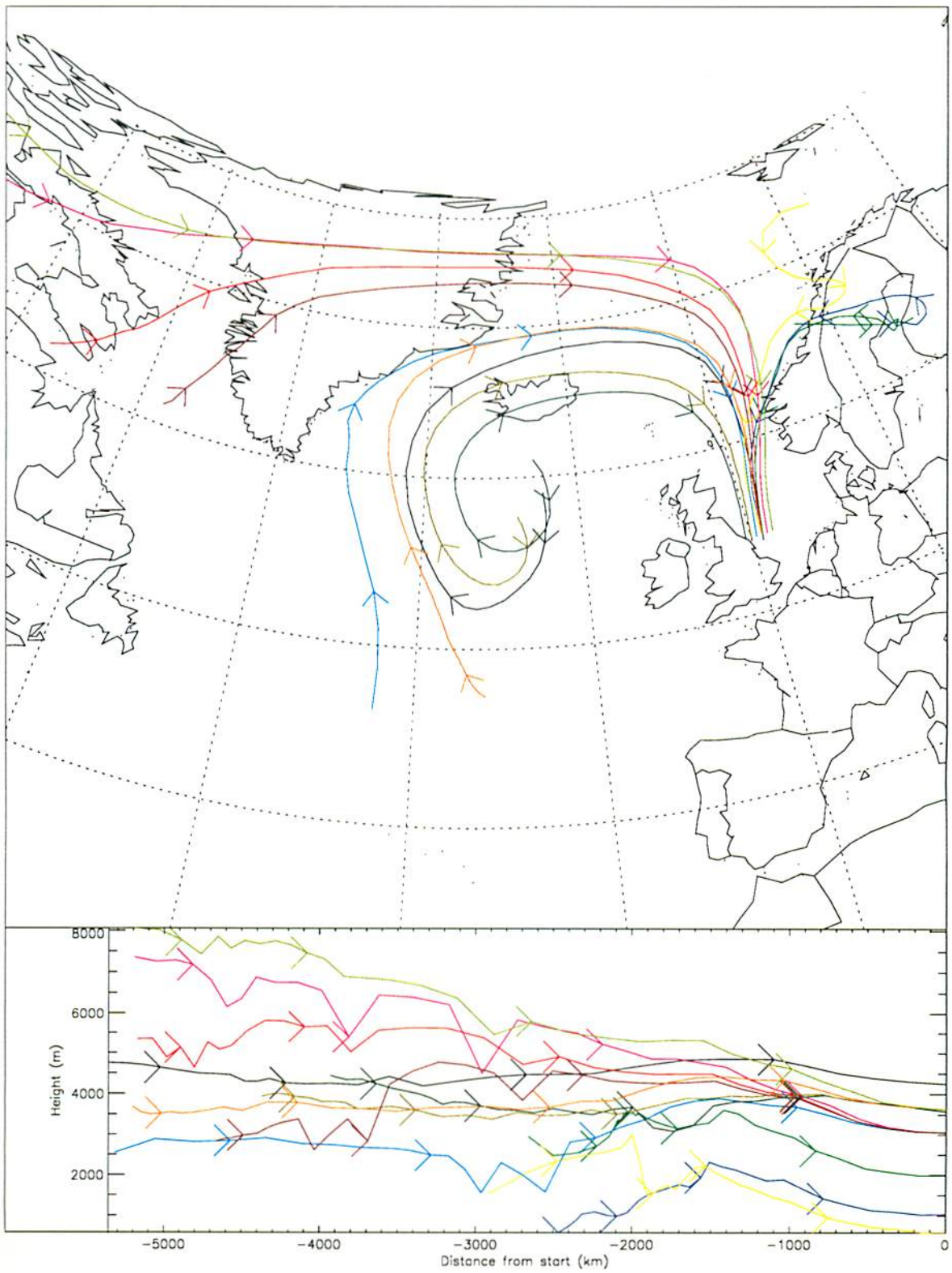

METEOROLOGICAL OFFICE FAX F 28
ASXX EGRR MSLP ANALYSIS DT 1200 UTC 13 SEP 1996
Polar Stereographic Projection. Standard Parallel 60°N. Original scale 1:20m
** TOTAL PAGE.001 **
MET_OFFICE_ARTIFAX_1 PAGE.001
13 SEP '96 15:45
GEOSTROPHIC WIND SCALE
IN KNOTS FOR 4 MB INTERVALS
80 25 10
70° 60° 50° 40°
80 40 25 15 10
SCALE OF NAUTICAL MILES
100 200 300 400 500 600 700
TROUGH
1026
1023
1020
1012
1000
990
994
998

A478.TXT

From 15Z 9/ 9/1996 to 15Z 13/ 9/1996

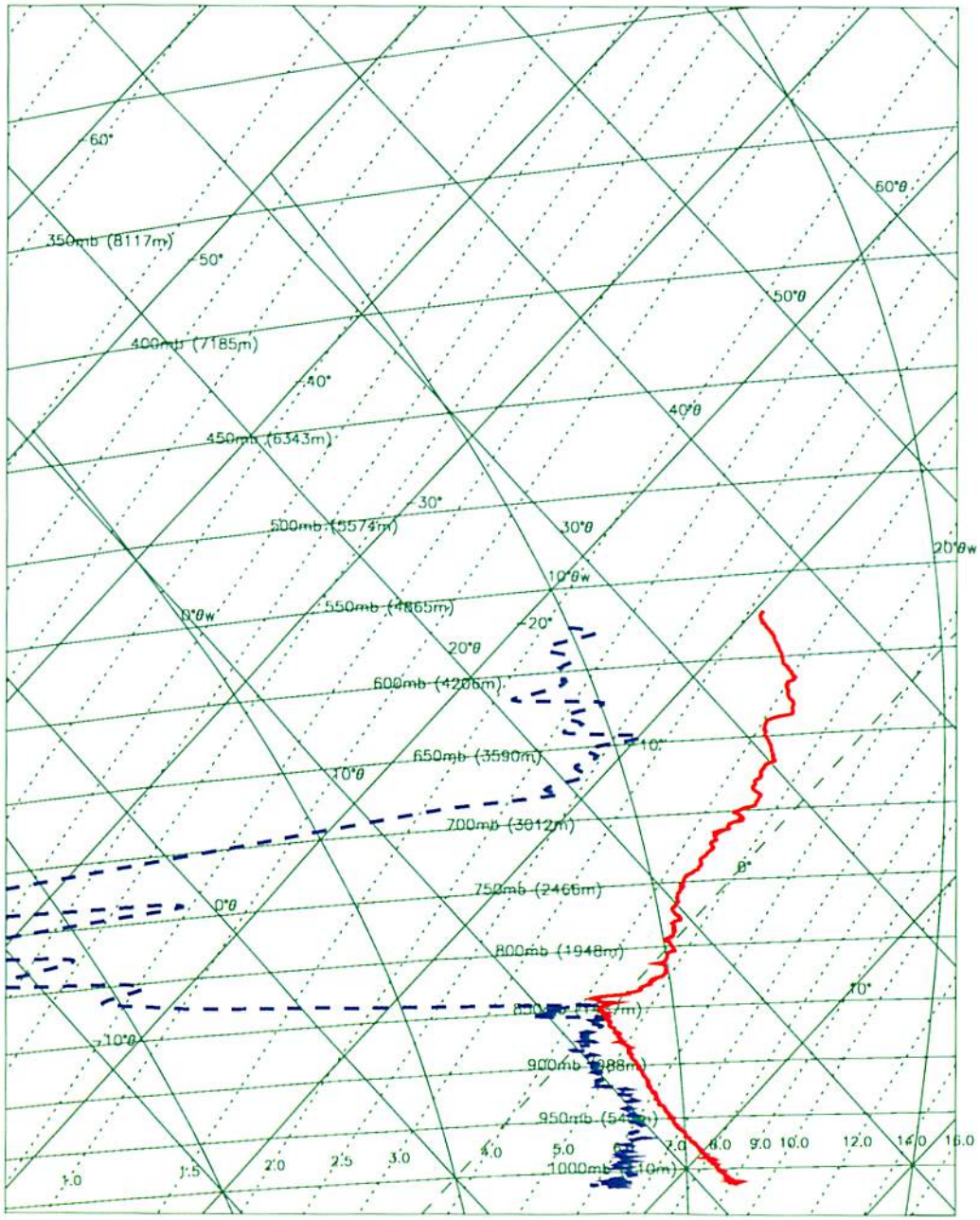
Arrows every 24 hrs

Plotted 27-Oct-1996 11:55

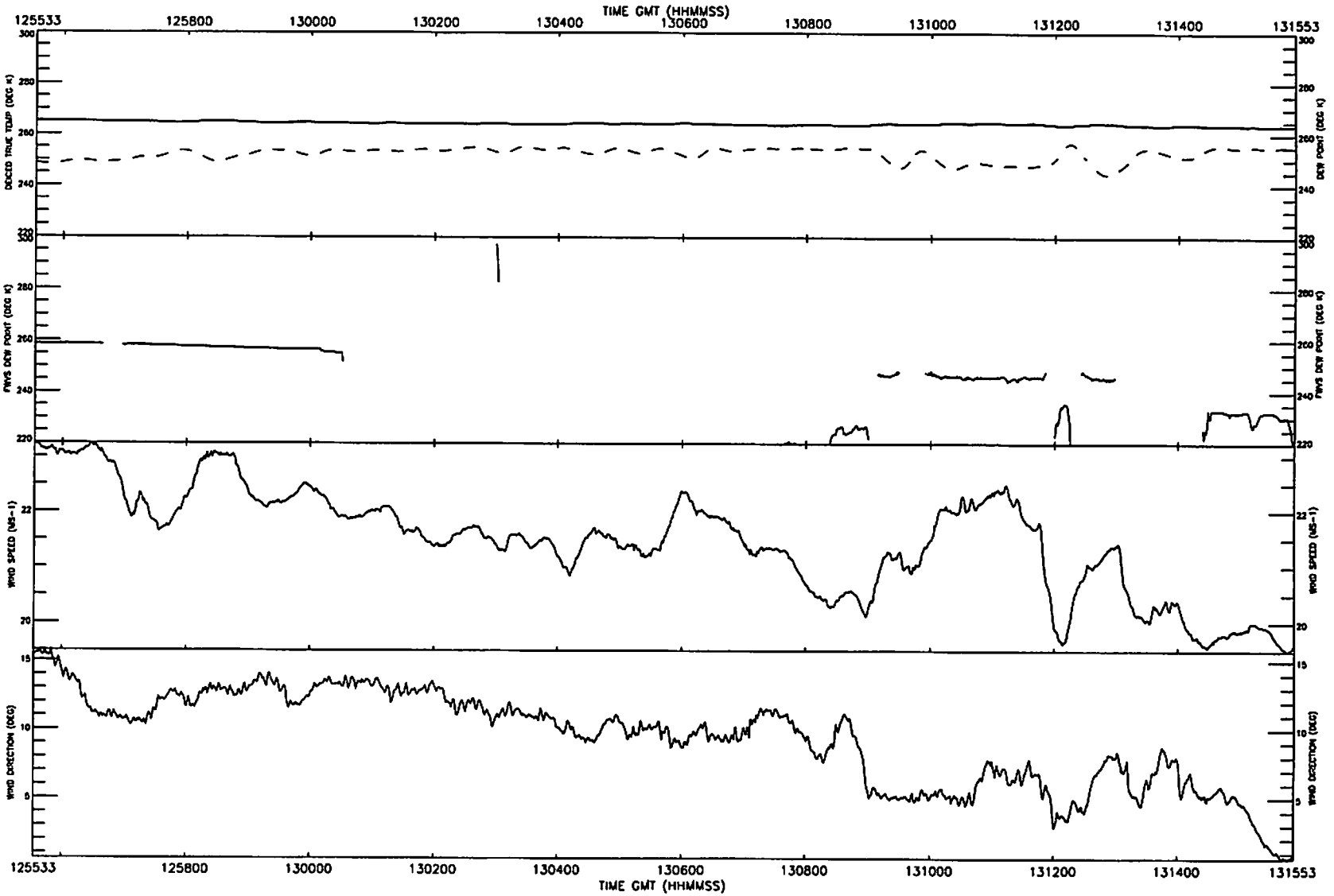


A478 13-SEP-96

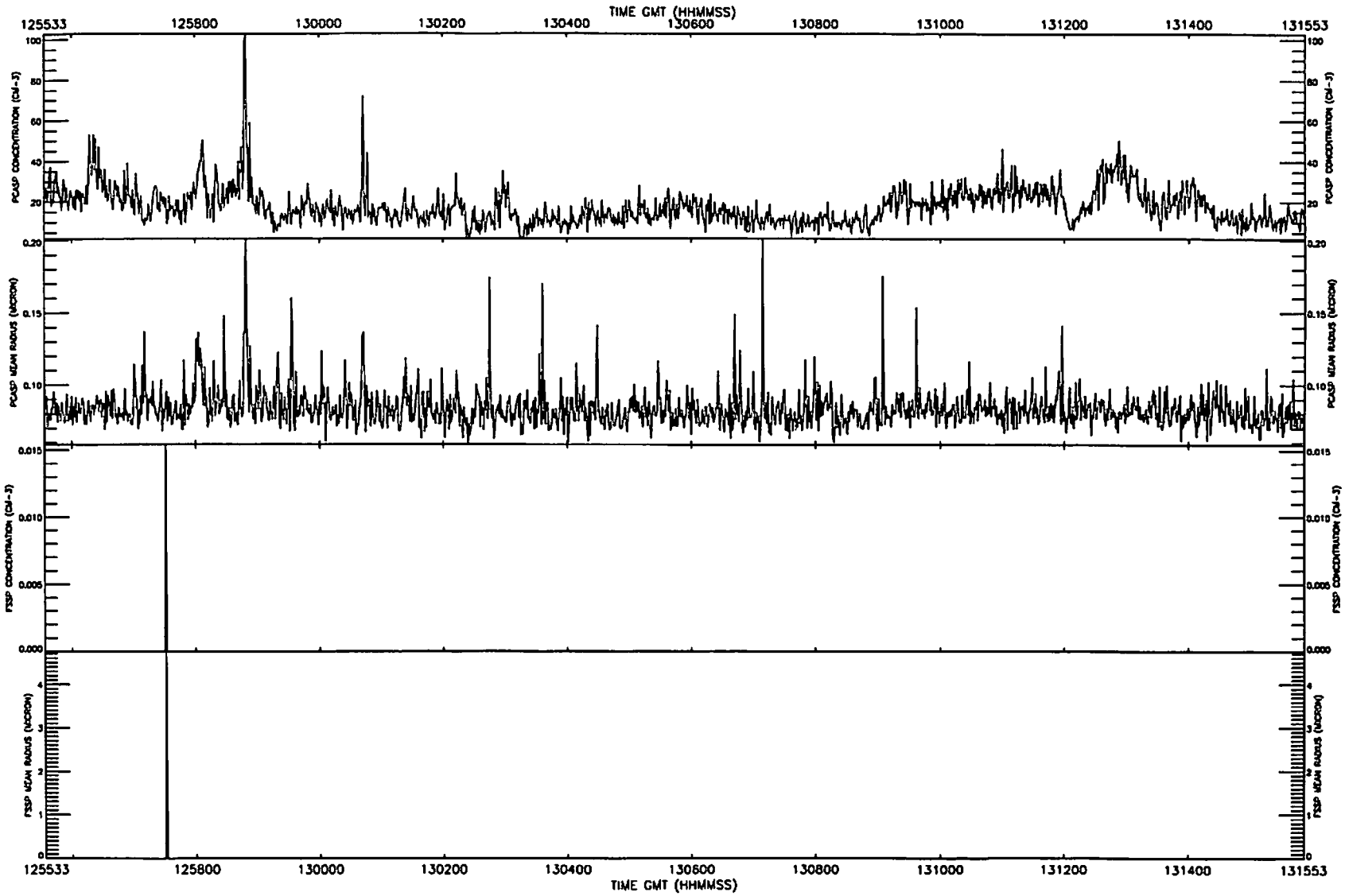
P1 FL150-50 ft(131845-133822)



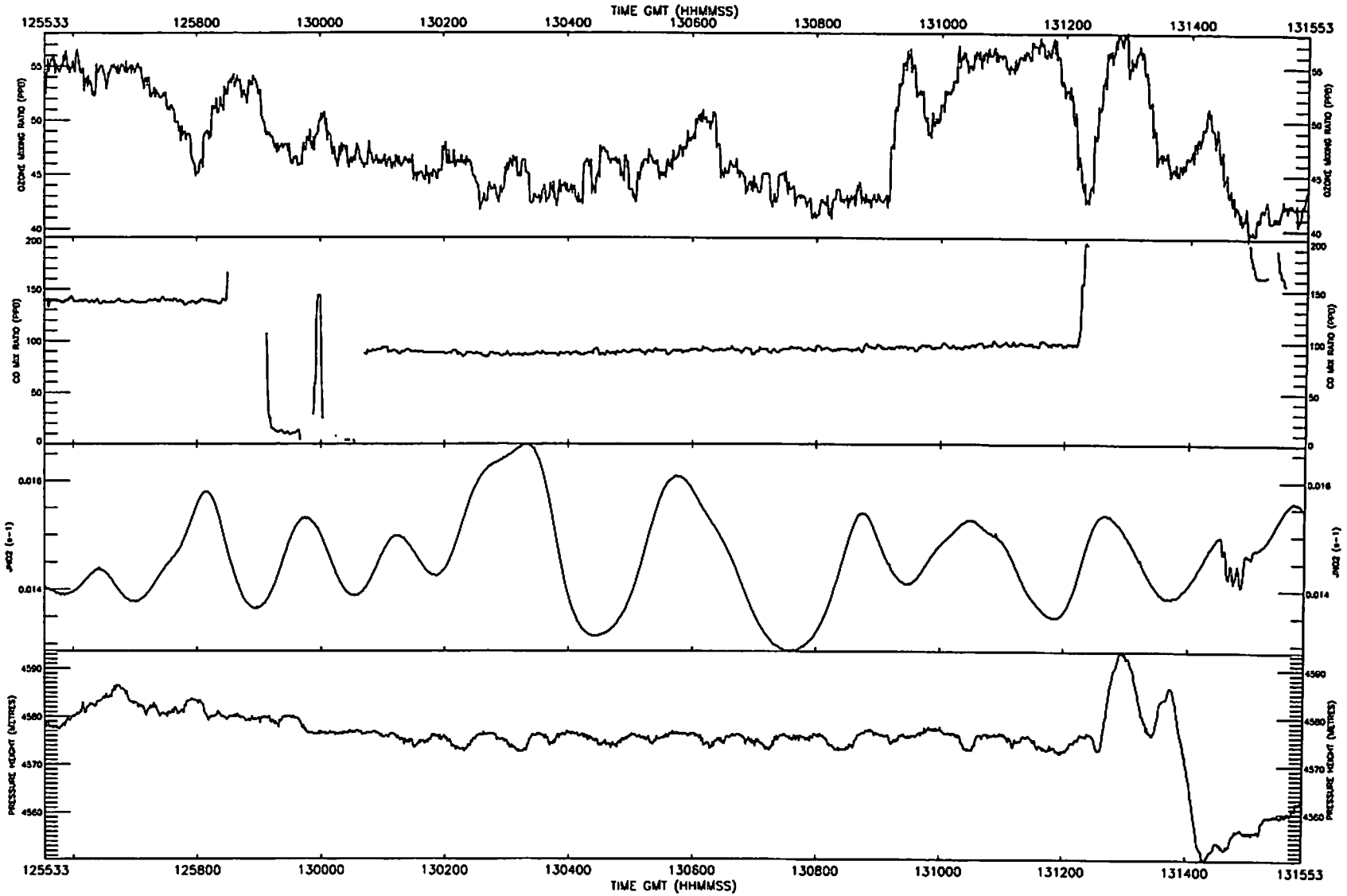
A478 13-SEP-96 R1 FL150 From 125533-131553 *Plotted 11-Oct-1996 15:02*



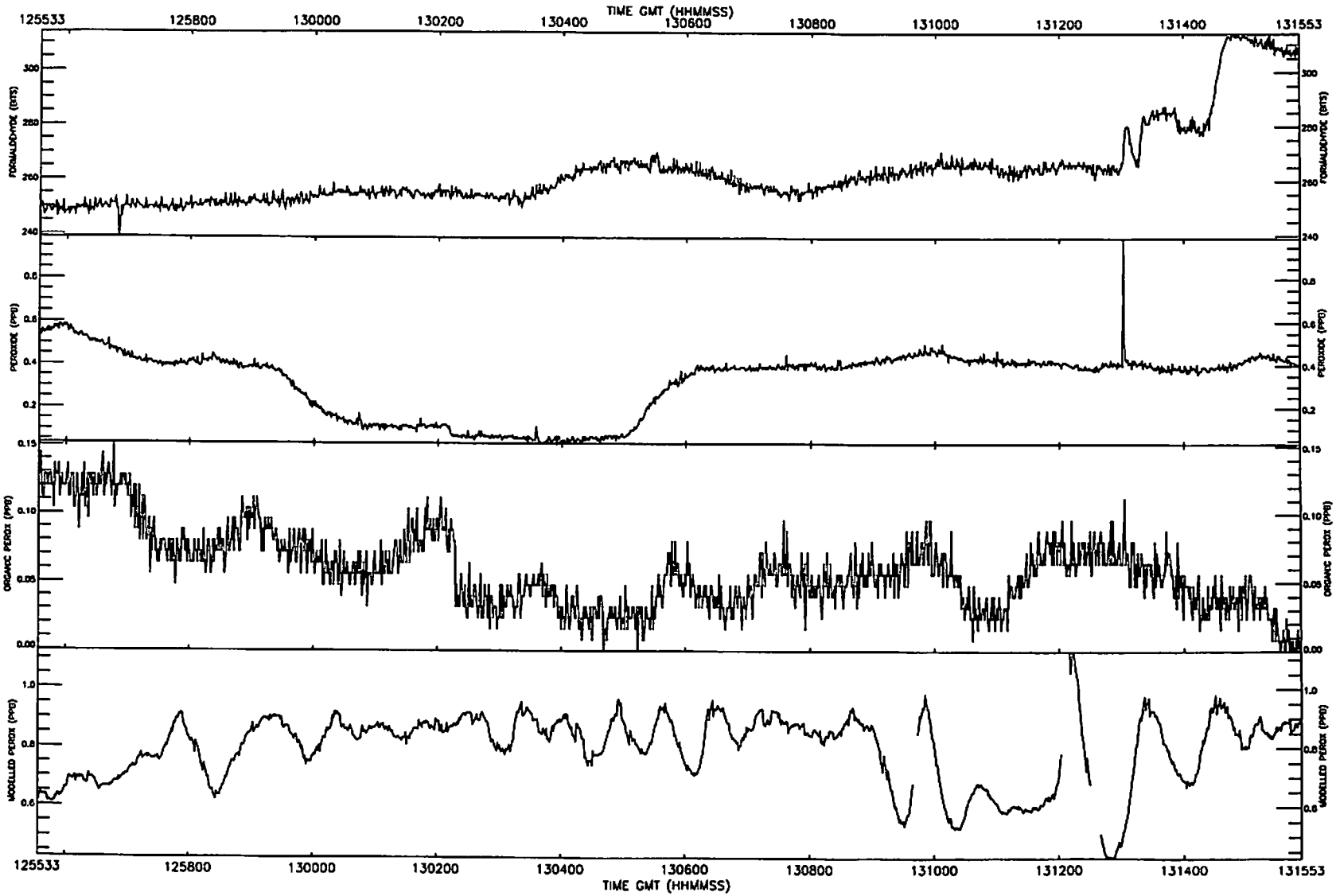
A478 13-SEP-96 R1 FL150 From 125533-131553 *Plotted 11-Oct-1996 15:03*



A478 13-SEP-96 R1 FL150 From 125533-131553 *Plotted 11-Oct-1996 15:03*



A478 13-SEP-96 R1 FL150 From 125533-131553 *Plotted 11-Oct-1996 15:03*



A478 13-SEP-96 R1 FL150 From 125533-131553 *Plotted 11-Oct-1996 15:03*

STATIC PRESSURE (MB)
No of obs 1221
Mean 571.557
Standard dev 0.522811
Max value 573.458
Min value 570.181

DEICED TRUE TEMP (DEG K)
No of obs 1221
Mean 264.324
Standard dev 0.381164
Max value 265.239
Min value 263.570

DEW POINT (DEG K)
No of obs 1221
Mean 252.375
Standard dev 2.54012
Max value 256.791
Min value 244.625

OZONE MIXING RATIO (PPB)
No of obs 1221
Mean 48.2022
Standard dev 4.79942
Max value 58.1042
Min value 39.1941

PCASP CONCENTRATION (CM-3)
No of obs 1221
Mean 17.7986
Standard dev 9.13187
Max value 102.832
Min value 2.00000

FSSP CONCENTRATION (CM-3)
No of obs 1221
Mean 1.263048e-05
Standard dev 4.413445e-04
Max value 1.542182e-02
Min value 0.000000

PRESSURE HEIGHT (METRES)
No of obs 1221
Mean 4575.40
Standard dev 6.91484
Max value 4593.63
Min value 4550.27

CORRECTED LATITUDE (DEGREES)
No of obs 1221
Mean 53.1237
Standard dev 0.427437
Max value 53.8262
Min value 52.3886

CORRECTED LONGITUDE (DEGREES)
No of obs 1221
Mean -0.530593
Standard dev 0.102311
Max value -0.401179
Min value -0.730197

NORTHWARD WIND COMPT (M S-1)
No of obs 1221
Mean -21.1579
Standard dev 0.795685
Max value -19.4926
Min value -22.7865

EASTWARD WIND COMPT (M S-1)
No of obs 1221
Mean -3.54222
Standard dev 1.33194
Max value -0.206070
Min value -6.29044

VERTICAL WIND COMPT (M S-1)
No of obs 1221
Mean 2.552577e-02
Standard dev 0.507669
Max value 1.26399
Min value -1.01292

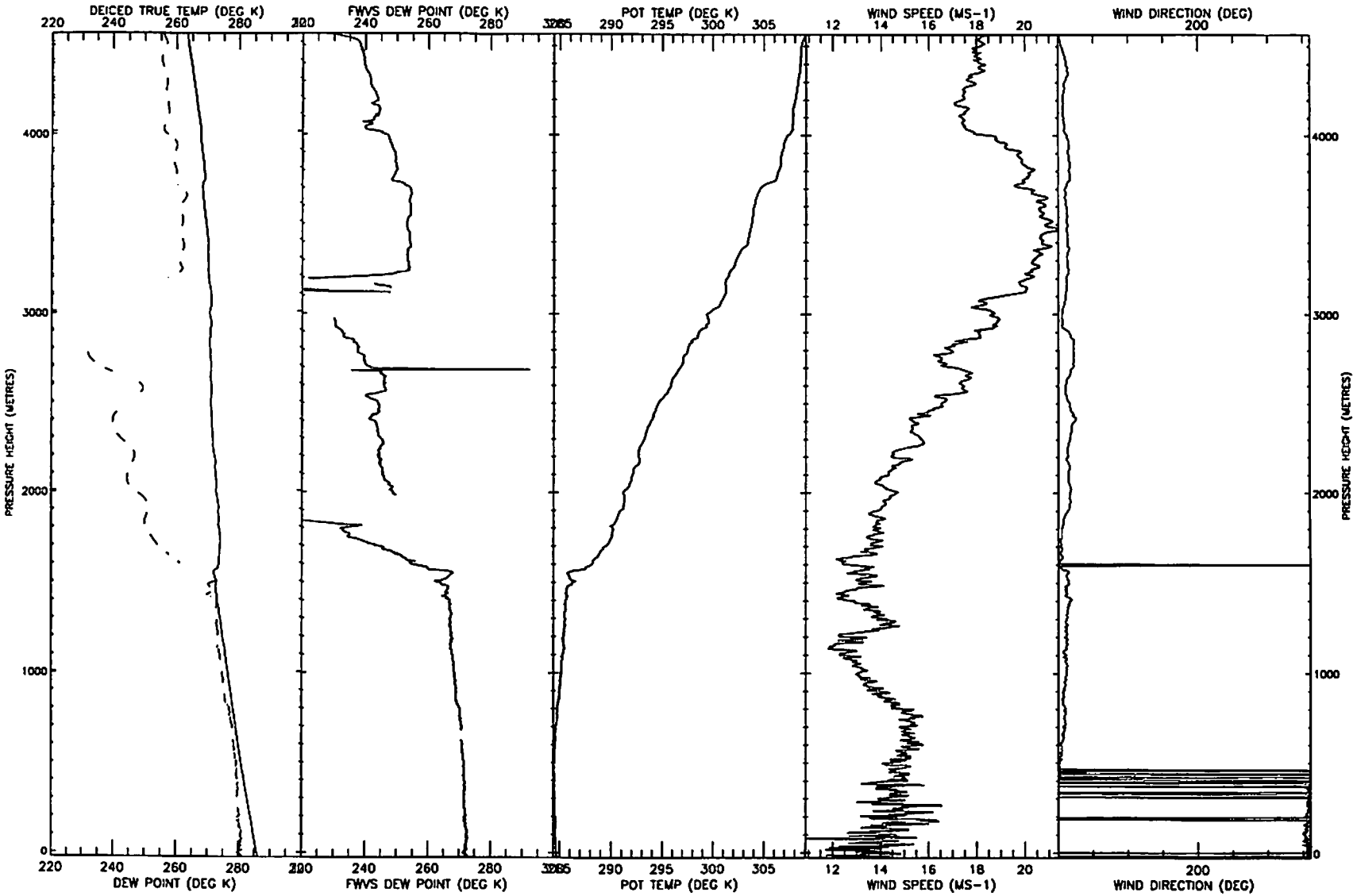
WIND SPEED (MS-1)
No of obs 1221
Mean 21.4885
Standard dev 0.925779
Max value 23.2438
Min value 19.4951

WIND DIRECTION (DEG)
Mean 9.50420

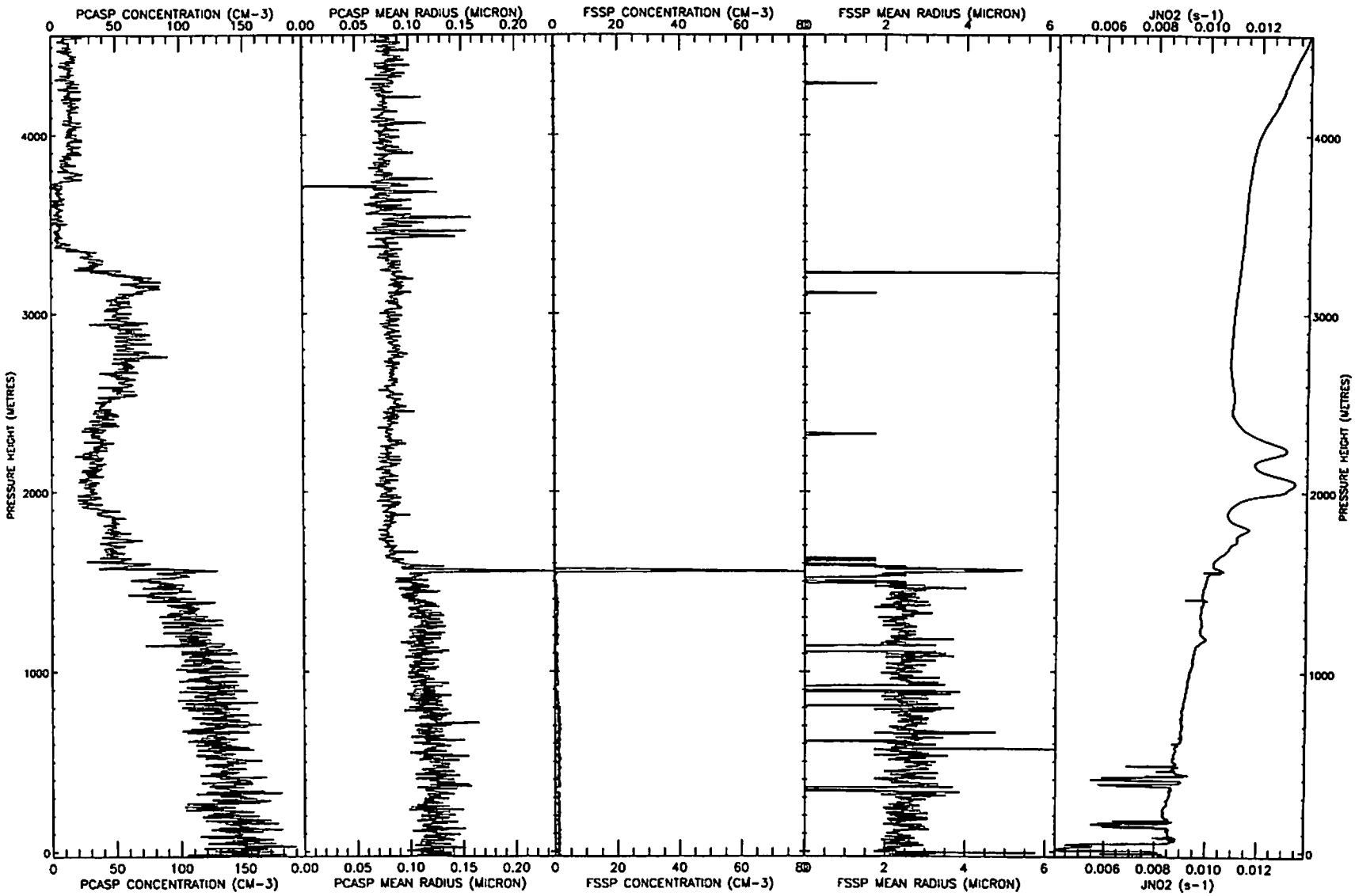
TRUE AIR SPEED (M S-1)
No of obs 1221
Mean 154.078
Standard dev 12.6147
Max value 162.163
Min value 115.961

HEADING (DEG)
Mean 7.73371

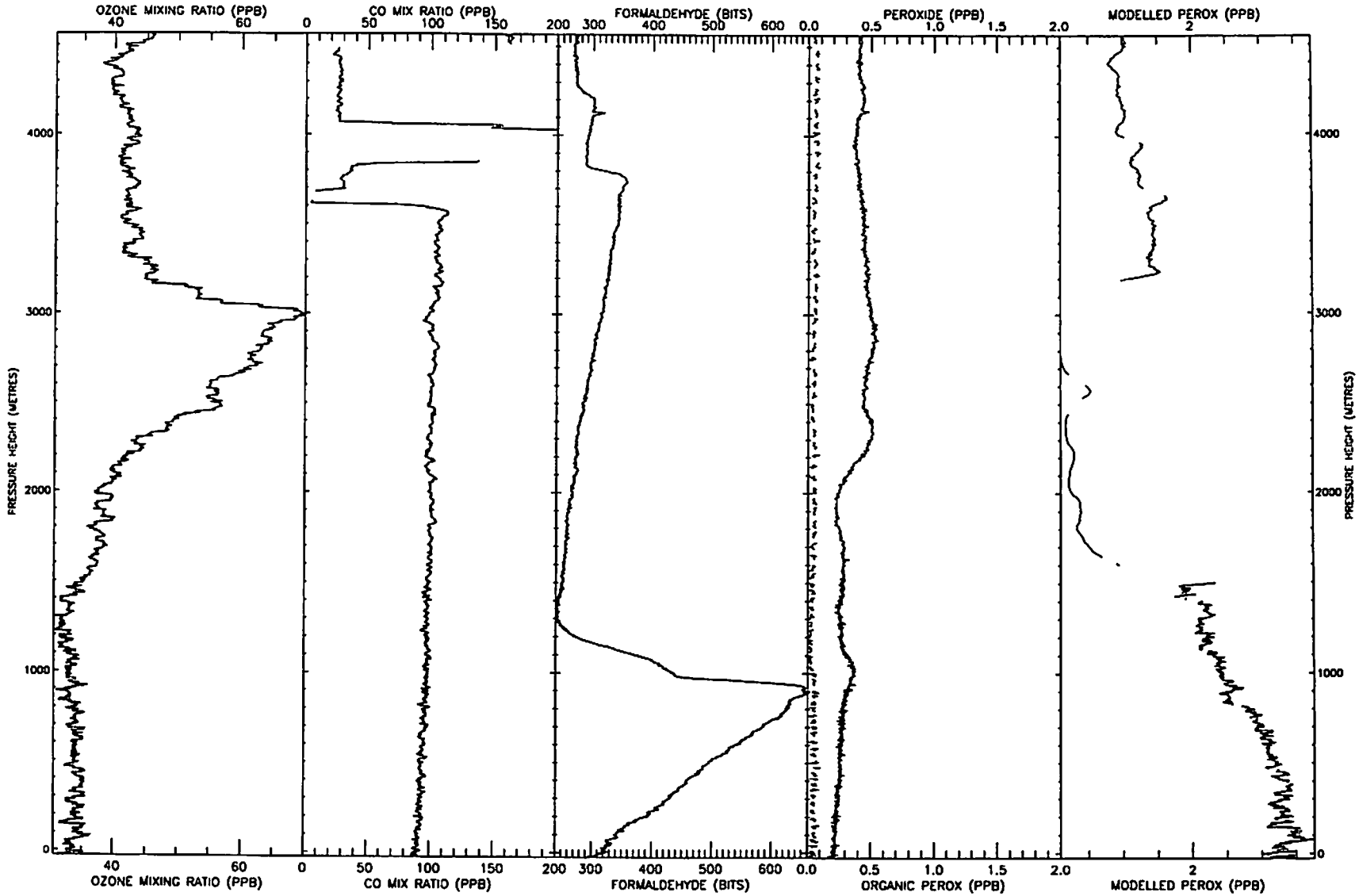
A478 13-SEP-96 P1 FL150-50 ft From 131845-133822 *Plotted 11-Oct-1996 15:08*



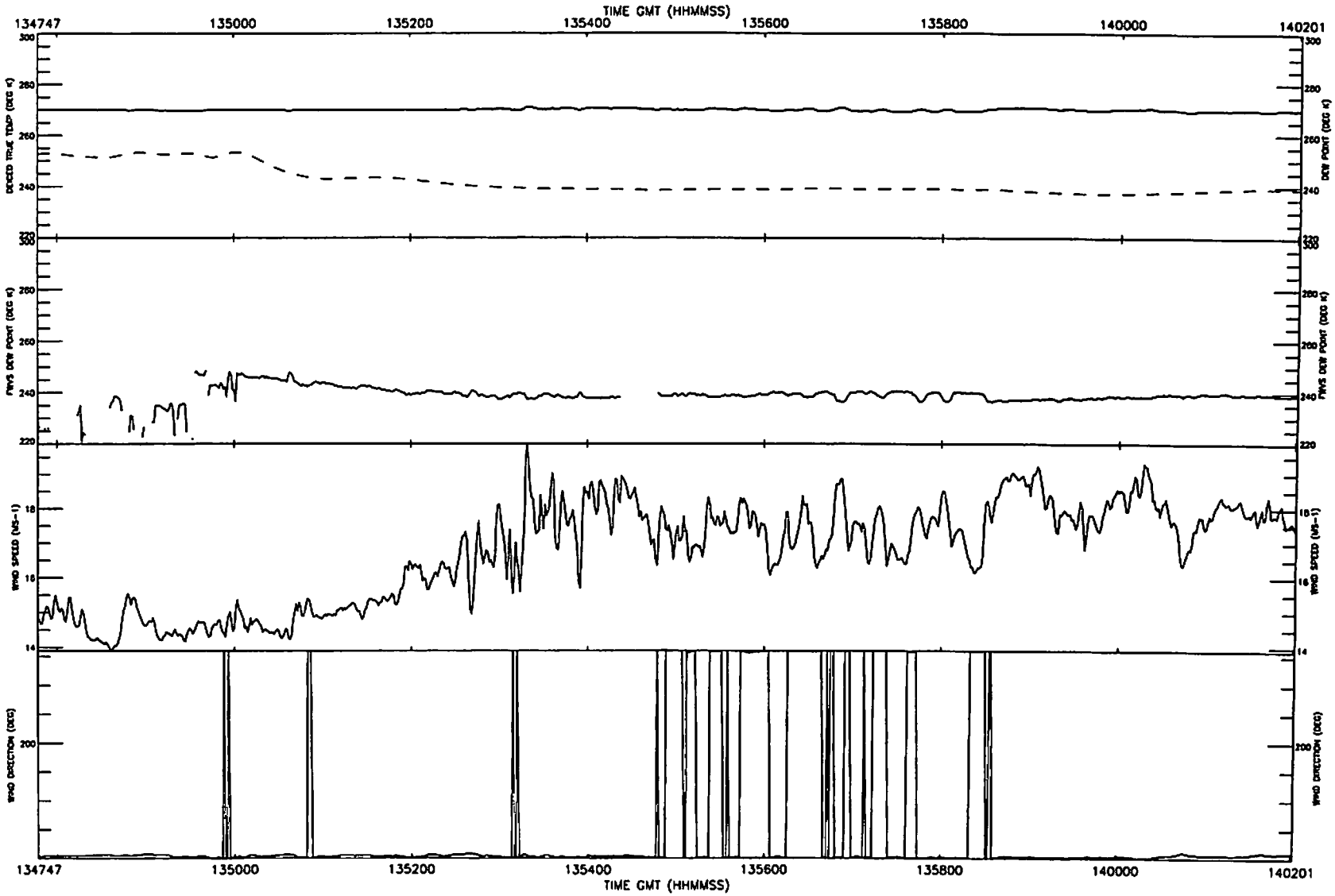
A478 13-SEP-96 P1 FL150-50 ft From 131845-133822 *Plotted 11-Oct-1996 15:08*



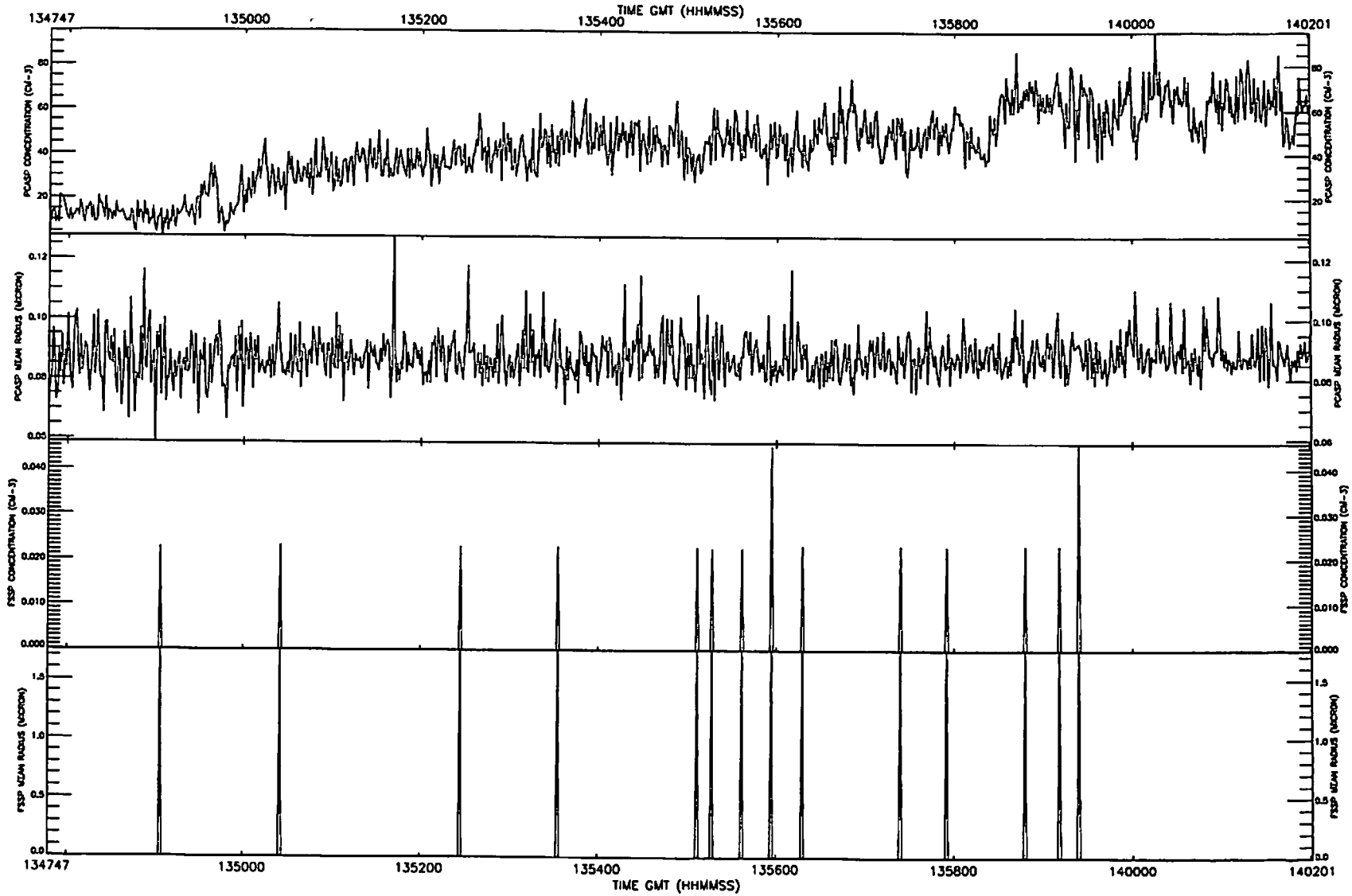
A478 13-SEP-96 P1 FL150-50 ft From 131845-133822 *Plotted 11-Oct-1996 15:09*



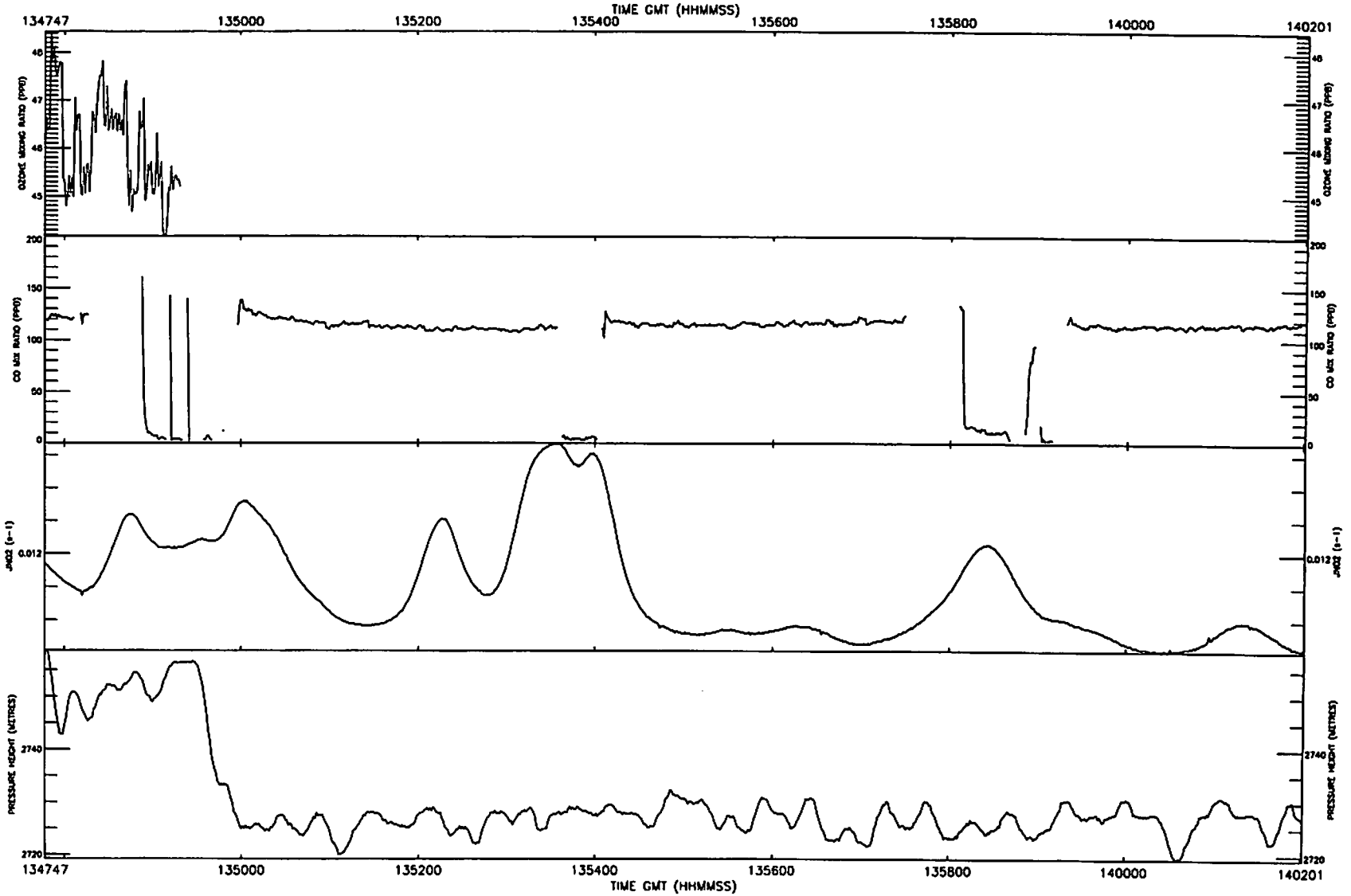
A478 13-SEP-96 R2 FL090 From 134747-140201 *Plotted 11-Oct-1996 16:05*



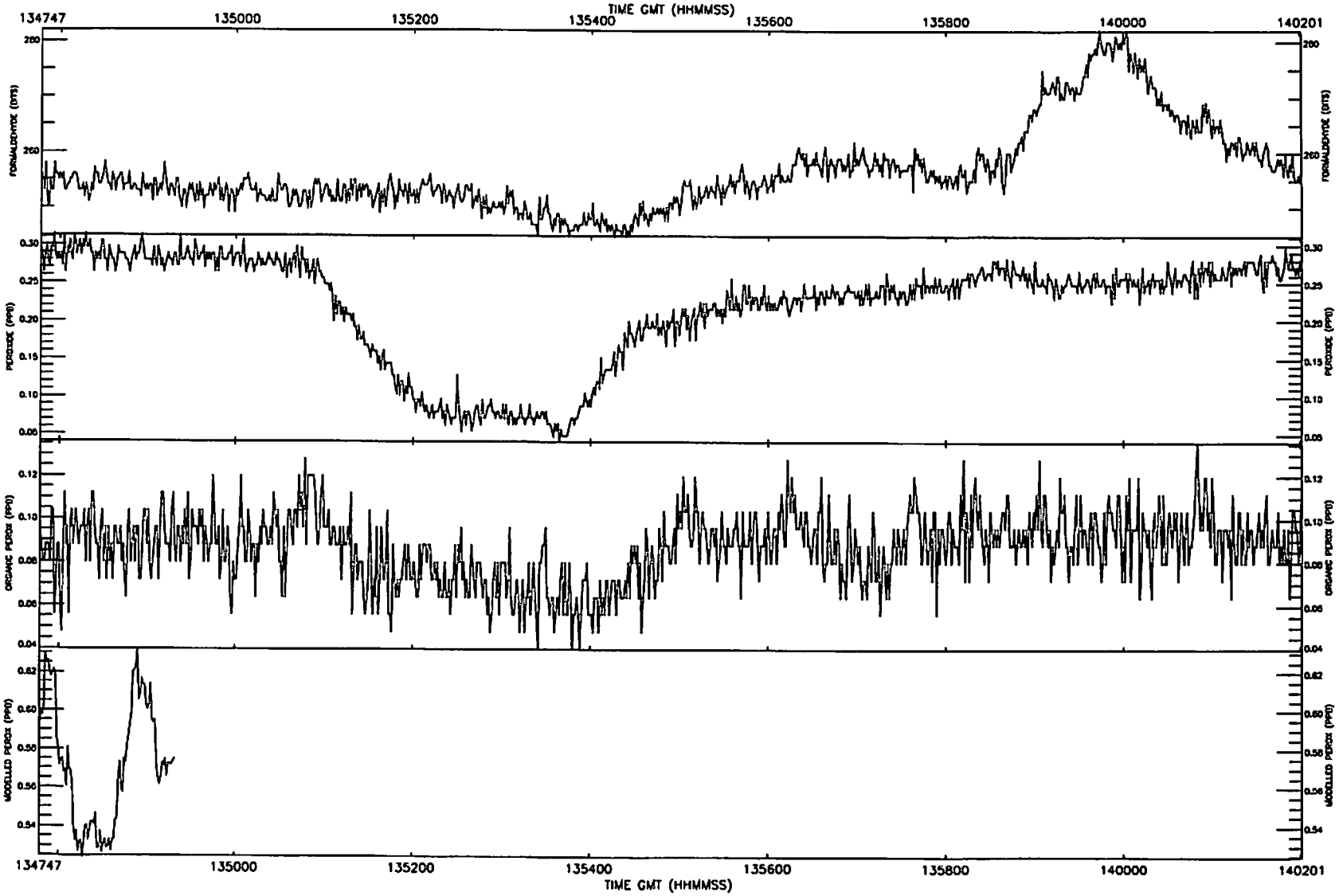
A478 13-SEP-96 R2 FL090 From 134747-140201 *Plotted 11-Oct-1996 16:05*



A478 13-SEP-96 R2 FL090 From 134747-140201 *Plotted 11-Oct-1996 16:05*



A478 13-SEP-96 R2 FL090 From 134747-140201 *Plotted 11-Oct-1996 16:06*



A478 13-SEP-96 R2 FL090 From 134747-140201 *Plotted 11-Oct-1996 16:06*

STATIC PRESSURE (MB)
No of obs 855
Mean 725.488
Standard dev 0.811316
Max value 726.480
Min value 722.861

DEICED TRUE TEMP (DEG K)
No of obs 855
Mean 270.017
Standard dev 0.345940
Max value 270.977
Min value 269.177

DEW POINT (DEG K)
No of obs 855
Mean 241.900
Standard dev 5.24800
Max value 253.267
Min value 237.240

OZONE MIXING RATIO (PPB)
No of obs 855
Mean 5.00609
Standard dev 14.3418
Max value 48.4377
Min value 1.000000e-38

PCASP CONCENTRATION (CM-3)
No of obs 855
Mean 43.1310
Standard dev 17.7092
Max value 95.1051
Min value 3.00010

FSSP CONCENTRATION (CM-3)
No of obs 855
Mean 4.259478e-04
Standard dev 3.457679e-03
Max value 4.597446e-02
Min value 0.000000

PRESSURE HEIGHT (METRES)
No of obs 855
Mean 2730.02
Standard dev 8.85894
Max value 2758.72
Min value 2719.21

CORRECTED LATITUDE (DEGREES)
No of obs 855
Mean 54.3343
Standard dev 1.644103e-02
Max value 54.3635
Min value 54.3037

CORRECTED LONGITUDE (DEGREES)
No of obs 855
Mean 1.24652
Standard dev 0.406813
Max value 1.95243
Min value 0.543261

NORTHWARD WIND COMPT (M S-1)
No of obs 855
Mean -16.7060
Standard dev 1.45064
Max value -13.8553
Min value -19.8561

EASTWARD WIND COMPT (M S-1)
No of obs 855
Mean -0.797933
Standard dev 0.757896
Max value 1.15845
Min value -3.15170

VERTICAL WIND COMPT (M S-1)
No of obs 855
Mean 5.575237e-02
Standard dev 0.329620
Max value 0.940605
Min value -1.16733

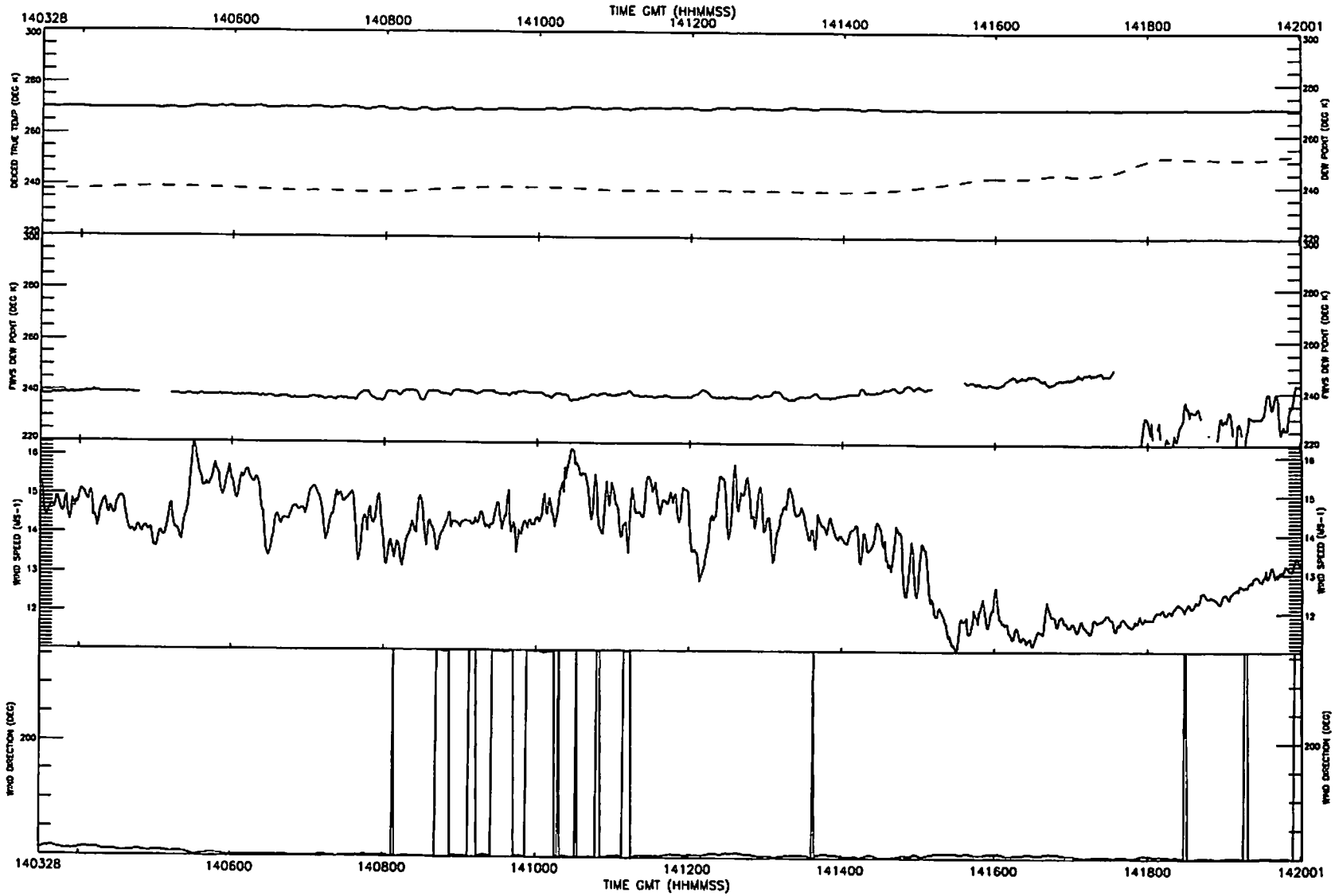
WIND SPEED (MS-1)
No of obs 855
Mean 16.7422
Standard dev 1.45035
Max value 19.8897
Min value 13.9033

WIND DIRECTION (DEG)
Mean 2.73456

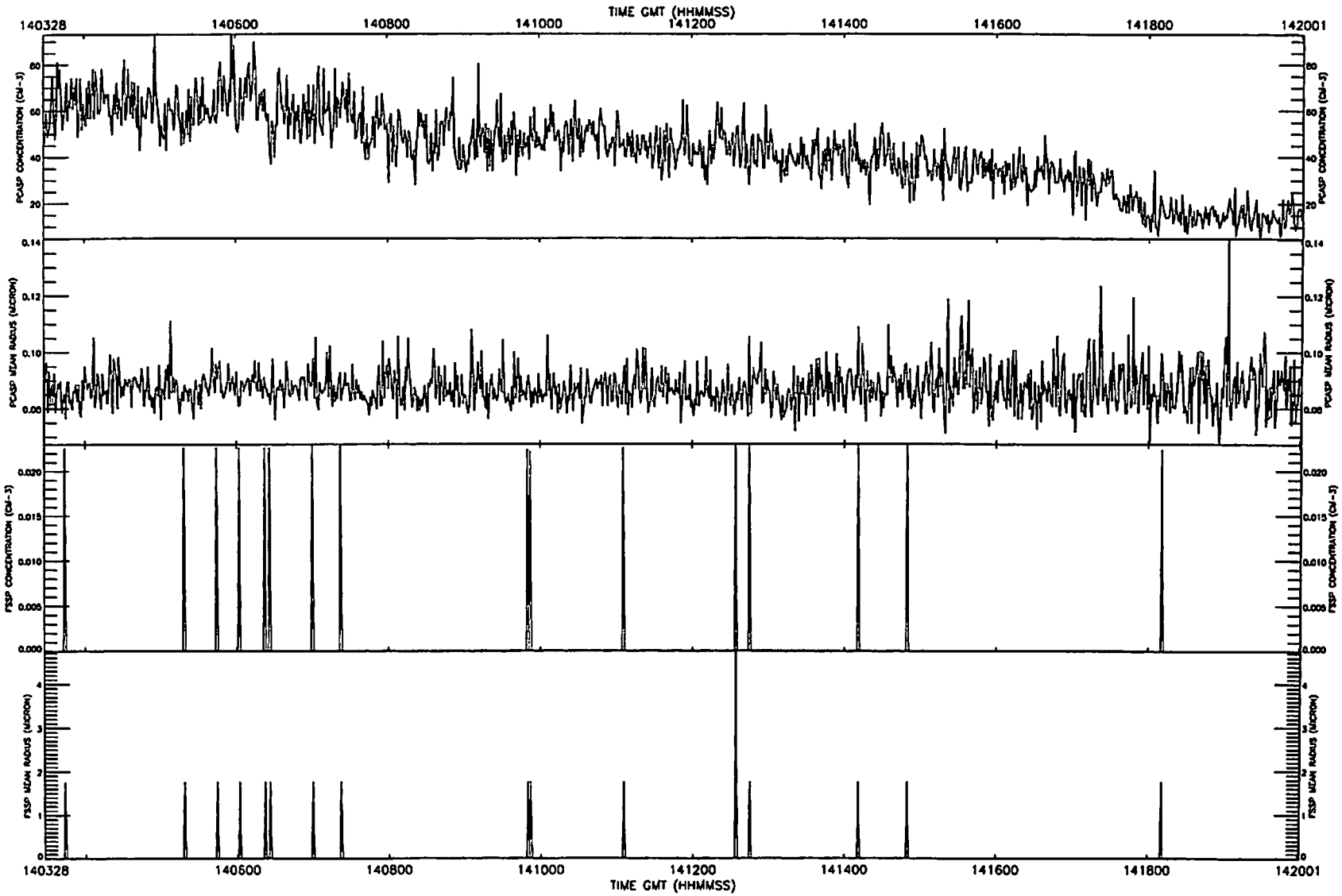
TRUE AIR SPEED (M S-1)
No of obs 855
Mean 106.739
Standard dev 0.937381
Max value 109.158
Min value 103.536

HEADING (DEG)
Mean 265.837

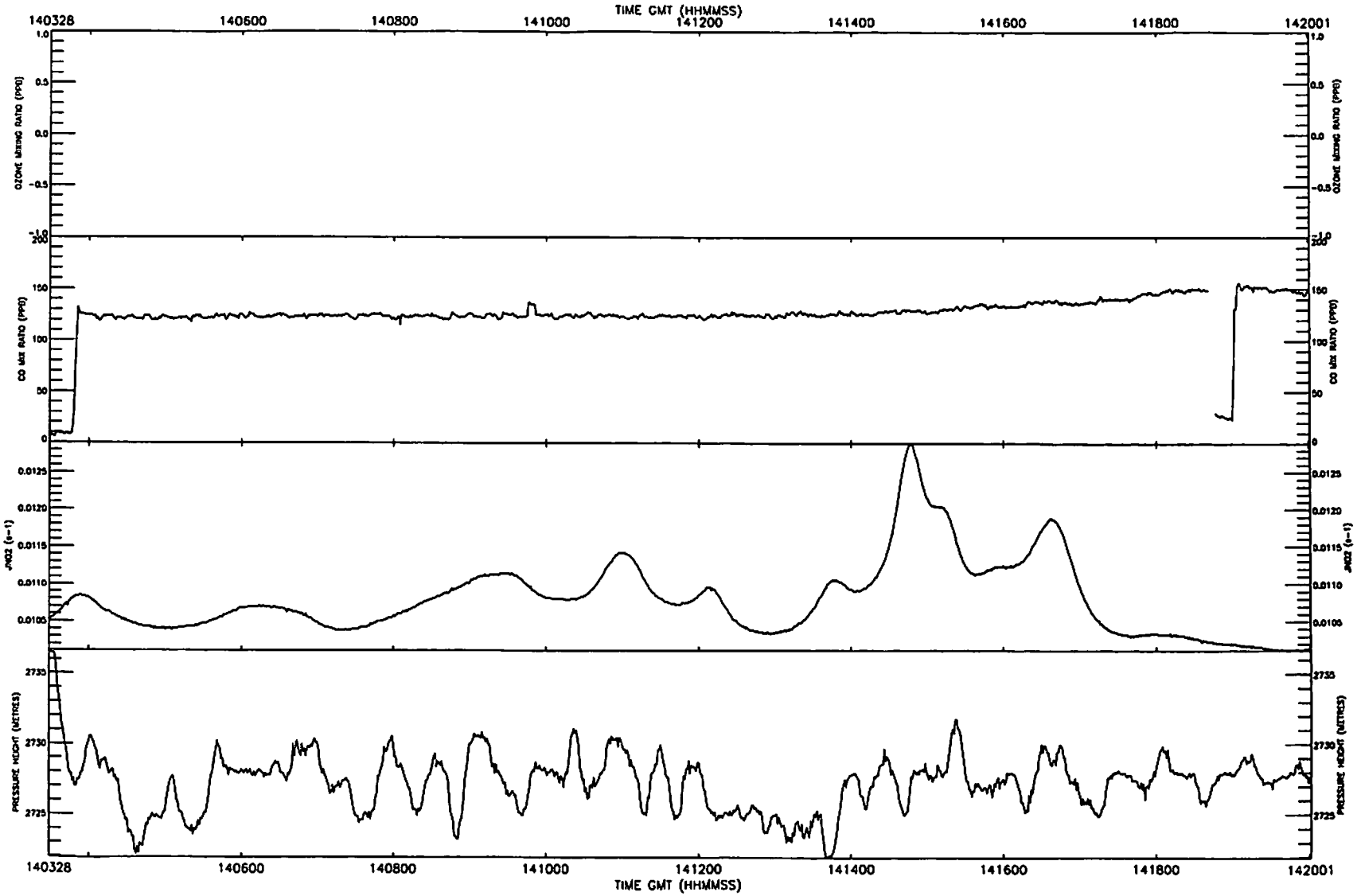
A478 13-SEP-96 R3 FL090 From 140328-142001 *Plotted 11-Oct-1996 15:22*



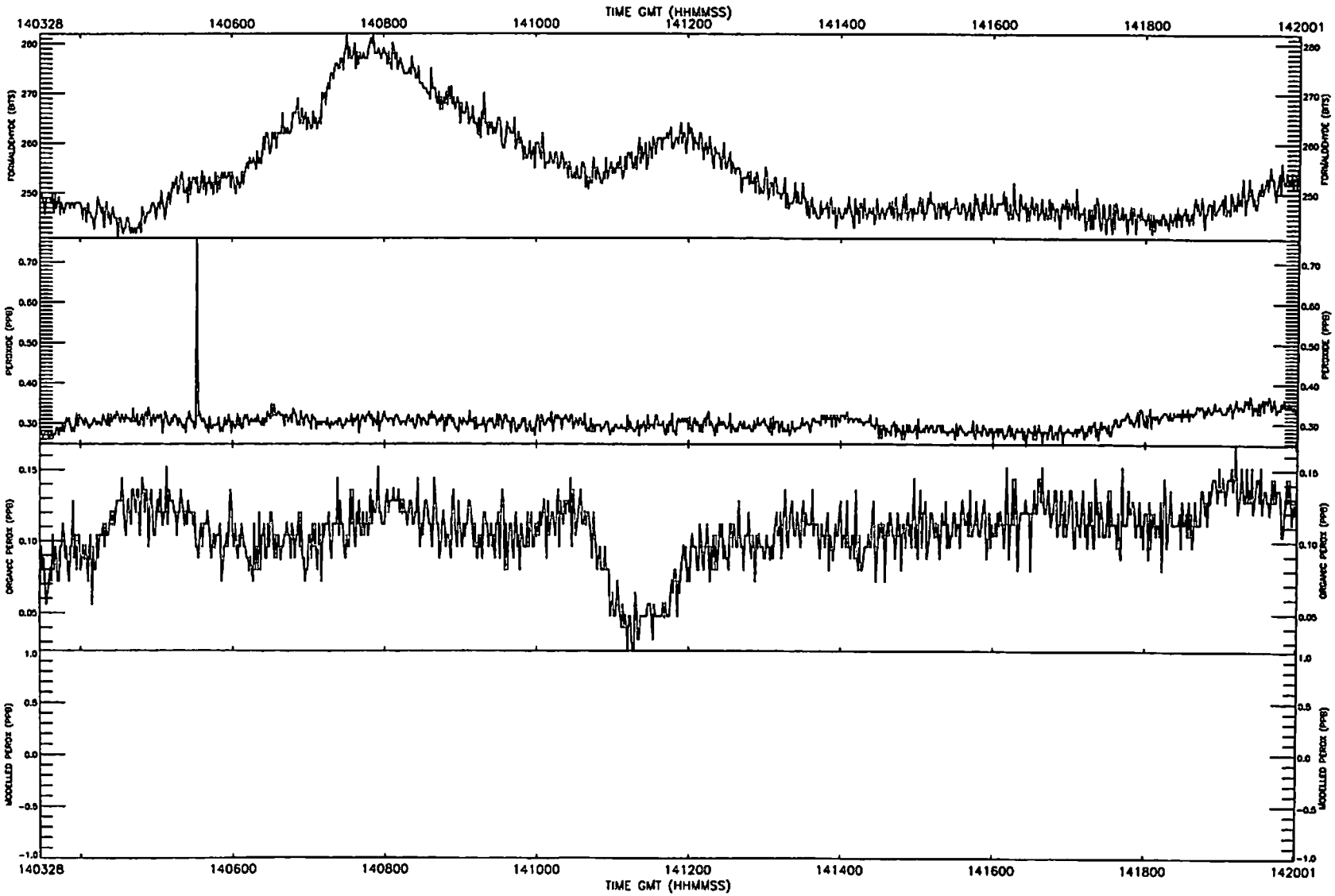
A478 13-SEP-96 R3 FL090 From 140328-142001 *Plotted 11-Oct-1996 15:22*



A478 13-SEP-96 R3 FL090 From 140328-142001 *Plotted 11-Oct-1996 15:22*



A478 13-SEP-96 R3 FL090 From 140328-142001 *Plotted 11-Oct-1996 15:22*



A478 13-SEP-96 R3 FL090 From 140328-142001 *Plotted 11-Oct-1996 15:22*

STATIC PRESSURE (MB)
No of obs 994
Mean 725.739
Standard dev 0.185439
Max value 726.228
Min value 724.881

DEICED TRUE TEMP (DEG K)
No of obs 994
Mean 270.151
Standard dev 0.345798
Max value 270.857
Min value 269.315

DEW POINT (DEG K)
No of obs 994
Mean 240.922
Standard dev 4.57448
Max value 252.650
Min value 237.232

OZONE MIXING RATIO (PPB)
No of obs 994
Mean 1.000000e-38
Standard dev 0.000000
Max value 1.000000e-38
Min value 1.000000e-38

PCASP CONCENTRATION (CM-3)
No of obs 994
Mean 42.9140
Standard dev 16.8936
Max value 93.0938
Min value 5.00016

FSSP CONCENTRATION (CM-3)
No of obs 994
Mean 3.642579e-04
Standard dev 2.849444e-03
Max value 2.298723e-02
Min value 0.000000

PRESSURE HEIGHT (METRES)
No of obs 994
Mean 2727.28
Standard dev 2.02243
Max value 2736.64
Min value 2721.95

CORRECTED LATITUDE (DEGREES)
No of obs 994
Mean 54.3538
Standard dev 7.903200e-03
Max value 54.3686
Min value 54.3385

CORRECTED LONGITUDE (DEGREES)
No of obs 994
Mean 1.32228
Standard dev 0.465136
Max value 2.13042
Min value 0.523038

NORTHWARD WIND COMPT (M S-1)
No of obs 994
Mean -13.6996
Standard dev 1.24423
Max value -10.9131
Min value -16.3279

EASTWARD WIND COMPT (M S-1)
No of obs 994
Mean -0.981366
Standard dev 0.923857
Max value 1.07308
Min value -4.15160

VERTICAL WIND COMPT (M S-1)
No of obs 994
Mean -1.264431e-02
Standard dev 0.269595
Max value 1.05960
Min value -0.873901

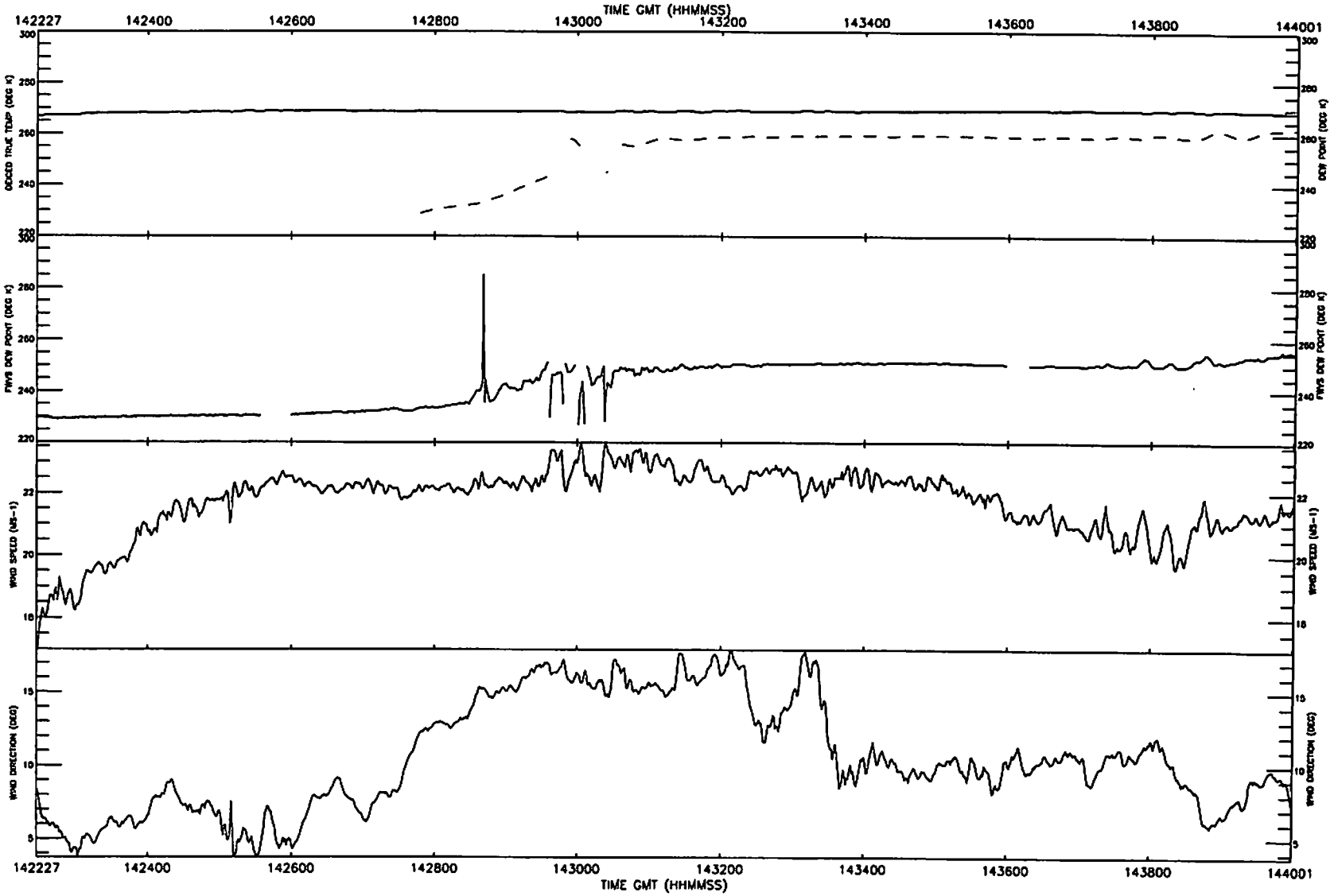
WIND SPEED (MS-1)
No of obs 994
Mean 13.7647
Standard dev 1.25447
Max value 16.3407
Min value 11.0251

WIND DIRECTION (DEG)
Mean 4.09738

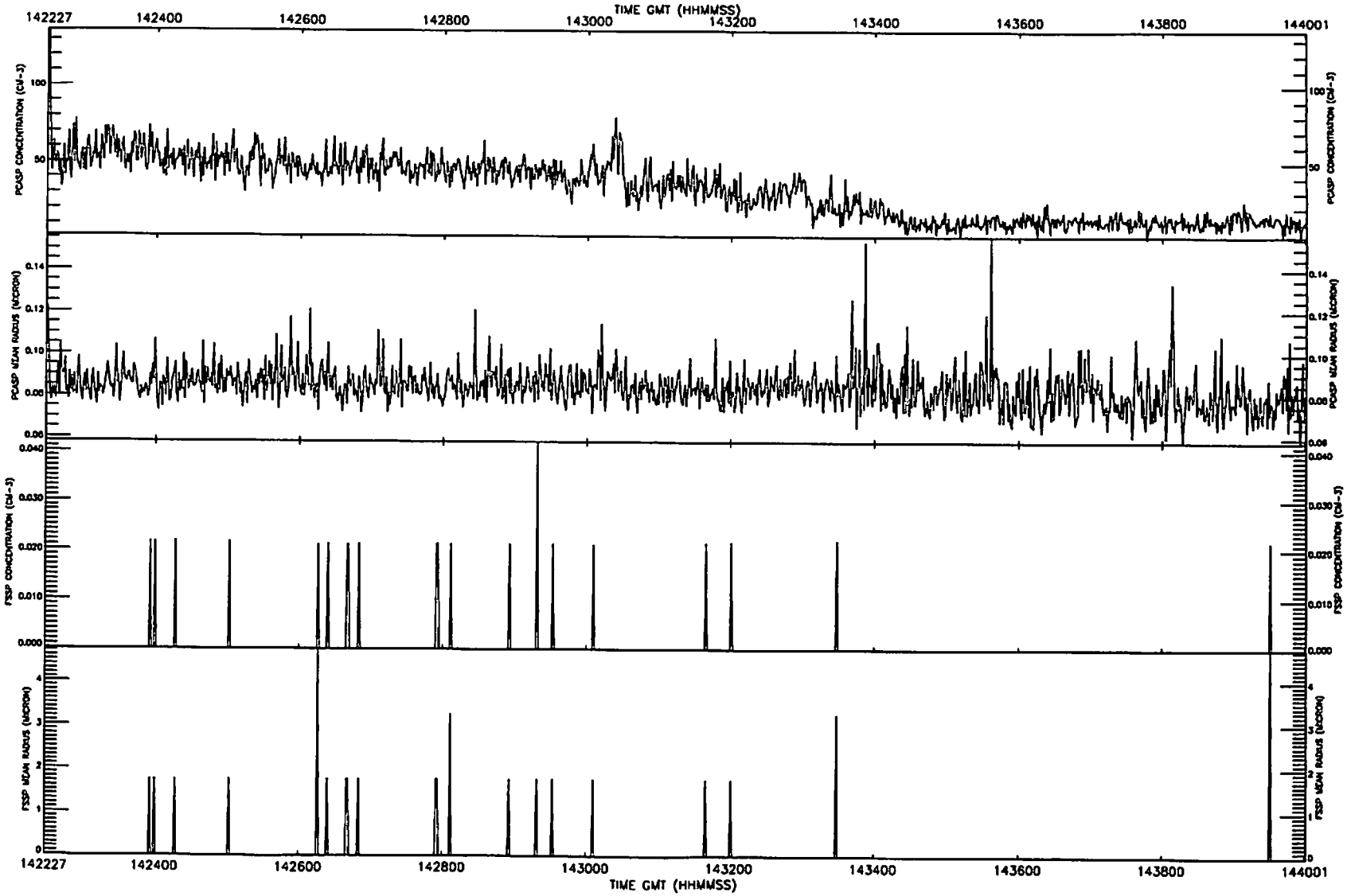
TRUE AIR SPEED (M S-1)
No of obs 994
Mean 107.436
Standard dev 1.15174
Max value 110.418
Min value 104.124

HEADING (DEG)
Mean 88.1662

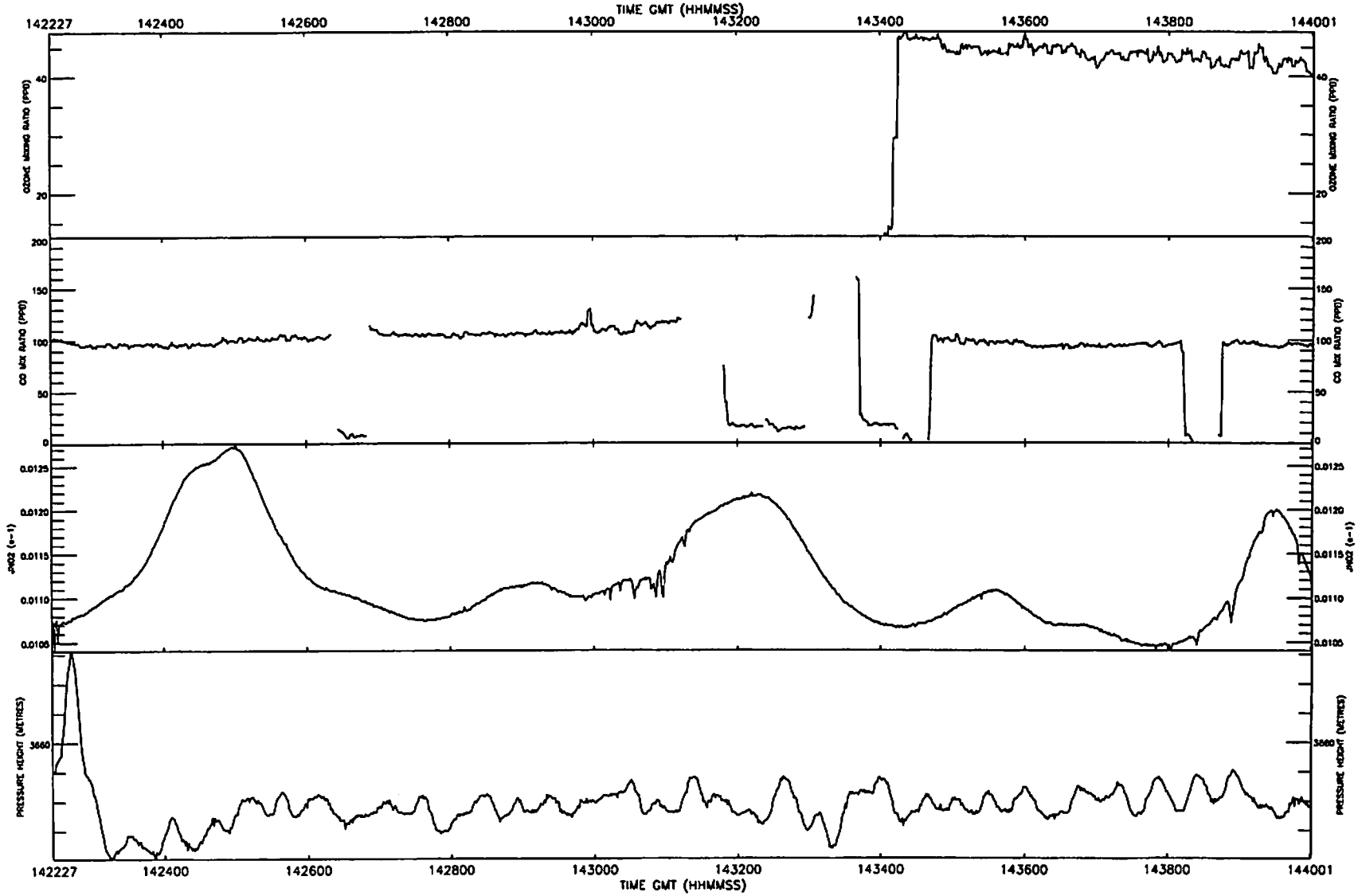
A478 13-SEP-96 R4 FL120 From 142227-144001 *Plotted 11-Oct-1996 16:15*



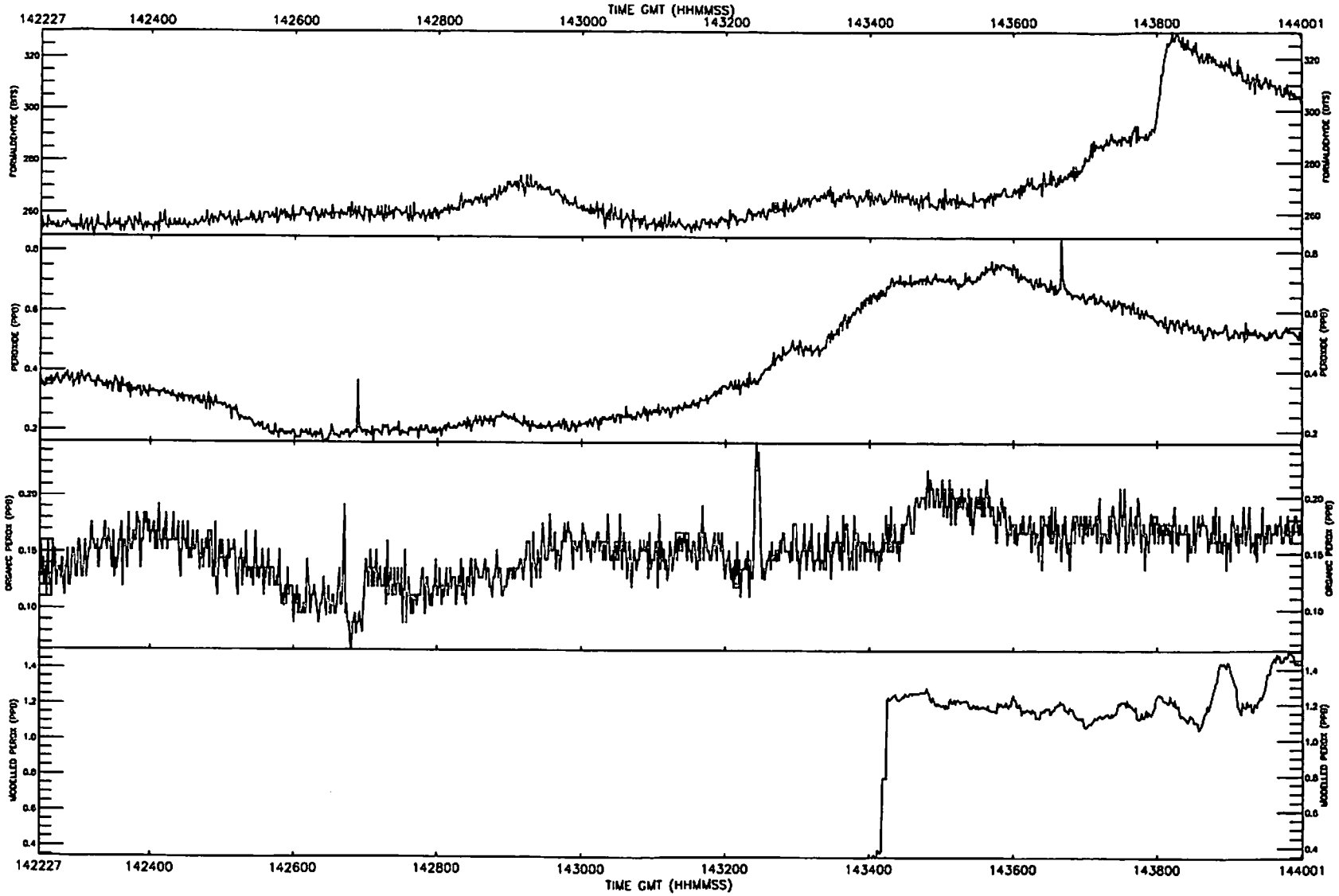
A478 13-SEP-96 R4 FL120 From 142227-144001 *Plotted 11-Oct-1996 16:15*



A478 13-SEP-96 R4 FL120 From 142227-144001 *Plotted 11-Oct-1996 16:16*



A478 13-SEP-96 R4 FL120 From 142227-144001 *Plotted 11-Oct-1996 16:16*



A478 13-SEP-96 R4 FL120 From 142227-144001 *Plotted 11-Oct-1996 16:16*

STATIC PRESSURE (MB)
No of obs 1055
Mean 645.096
Standard dev 0.319099
Max value 645.849
Min value 642.904

DEICED TRUE TEMP (DEG K)
No of obs 1055
Mean 268.774
Standard dev 0.523141
Max value 269.724
Min value 266.802

DEW POINT (DEG K)
No of obs 1055
Mean 247.358
Standard dev 13.6126
Max value 262.374
Min value 227.749

OZONE MIXING RATIO (PPB)
No of obs 1055
Mean 14.6244
Standard dev 20.6187
Max value 47.6853
Min value 1.000000e-38

PCASP CONCENTRATION (CM-3)
No of obs 1055
Mean 32.6262
Standard dev 18.4000
Max value 136.226
Min value 2.00006

FSSP CONCENTRATION (CM-3)
No of obs 1055
Mean 4.239373e-04
Standard dev 3.113908e-03
Max value 4.201251e-02
Min value 0.000000

PRESSURE HEIGHT (METRES)
No of obs 1055
Mean 3649.28
Standard dev 3.83039
Max value 3675.62
Min value 3640.26

CORRECTED LATITUDE (DEGREES)
No of obs 1055
Mean 54.3047
Standard dev 5.434243e-02
Max value 54.3961
Min value 54.2110

CORRECTED LONGITUDE (DEGREES)
No of obs 1055
Mean 1.06314
Standard dev 0.554012
Max value 2.01740
Min value 0.113976

NORTHWARD WIND COMPT (M S-1)
No of obs 1055
Mean -21.3051
Standard dev 0.941687
Max value -16.8308
Min value -22.8419

EASTWARD WIND COMPT (M S-1)
No of obs 1055
Mean -4.00584
Standard dev 1.51817
Max value -1.25352
Min value -6.80132

VERTICAL WIND COMPT (M S-1)
No of obs 1055
Mean -0.142551
Standard dev 0.381464
Max value 0.926498
Min value -1.35487

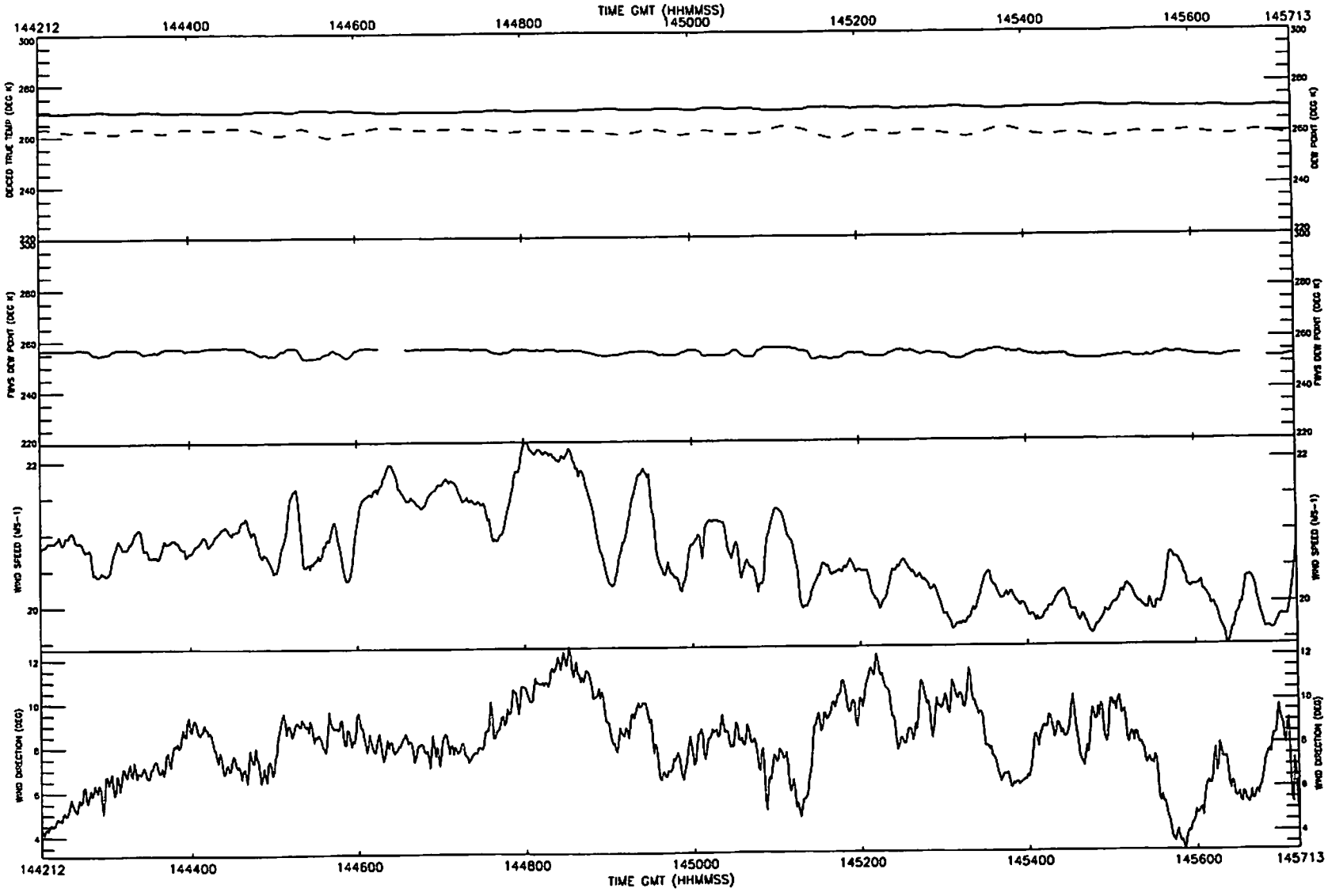
WIND SPEED (MS-1)
No of obs 1055
Mean 21.7254
Standard dev 1.07336
Max value 23.6238
Min value 17.0076

WIND DIRECTION (DEG)
Mean 10.6486

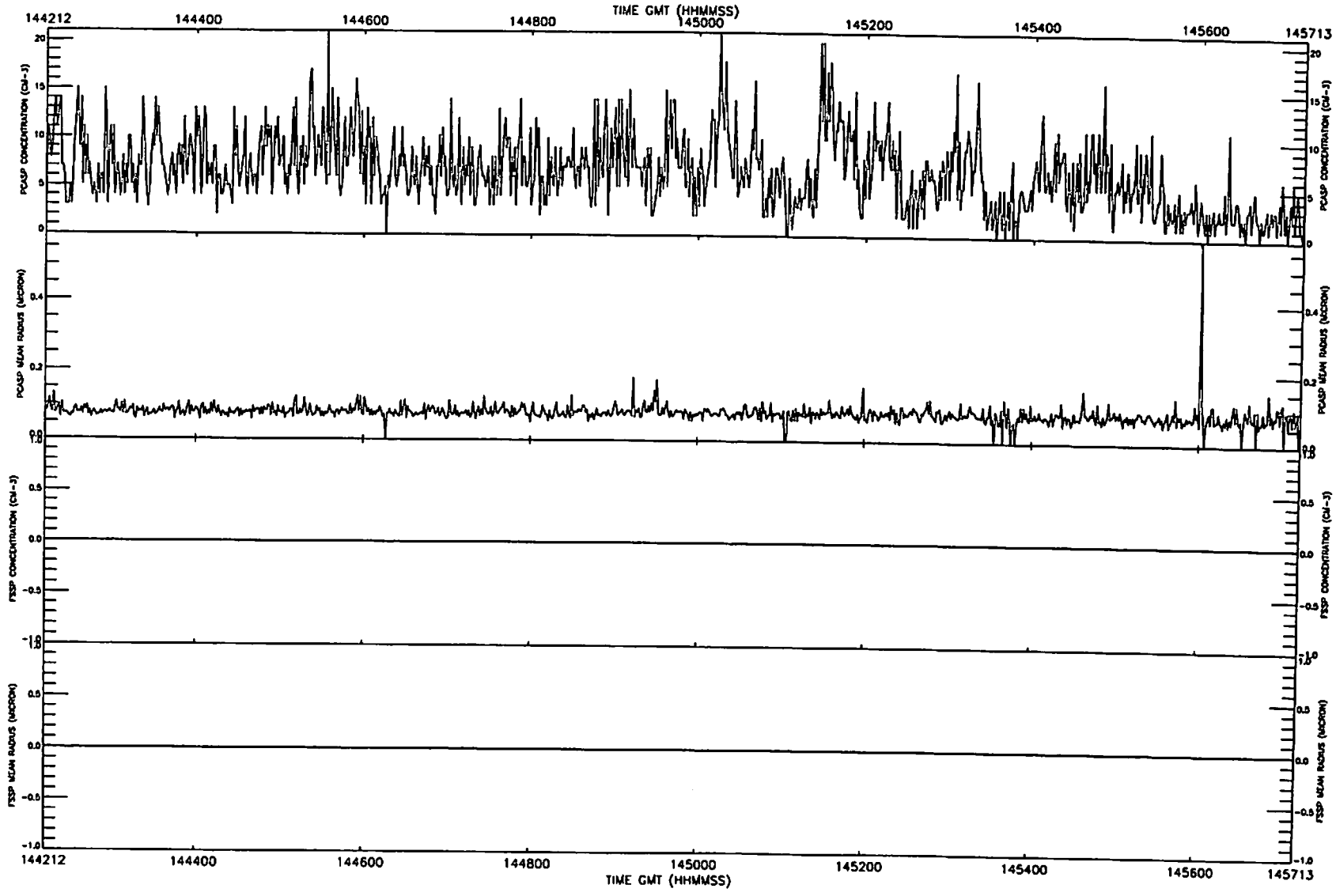
TRUE AIR SPEED (M S-1)
No of obs 1055
Mean 113.401
Standard dev 1.58262
Max value 116.991
Min value 110.471

HEADING (DEG)
Mean 260.552

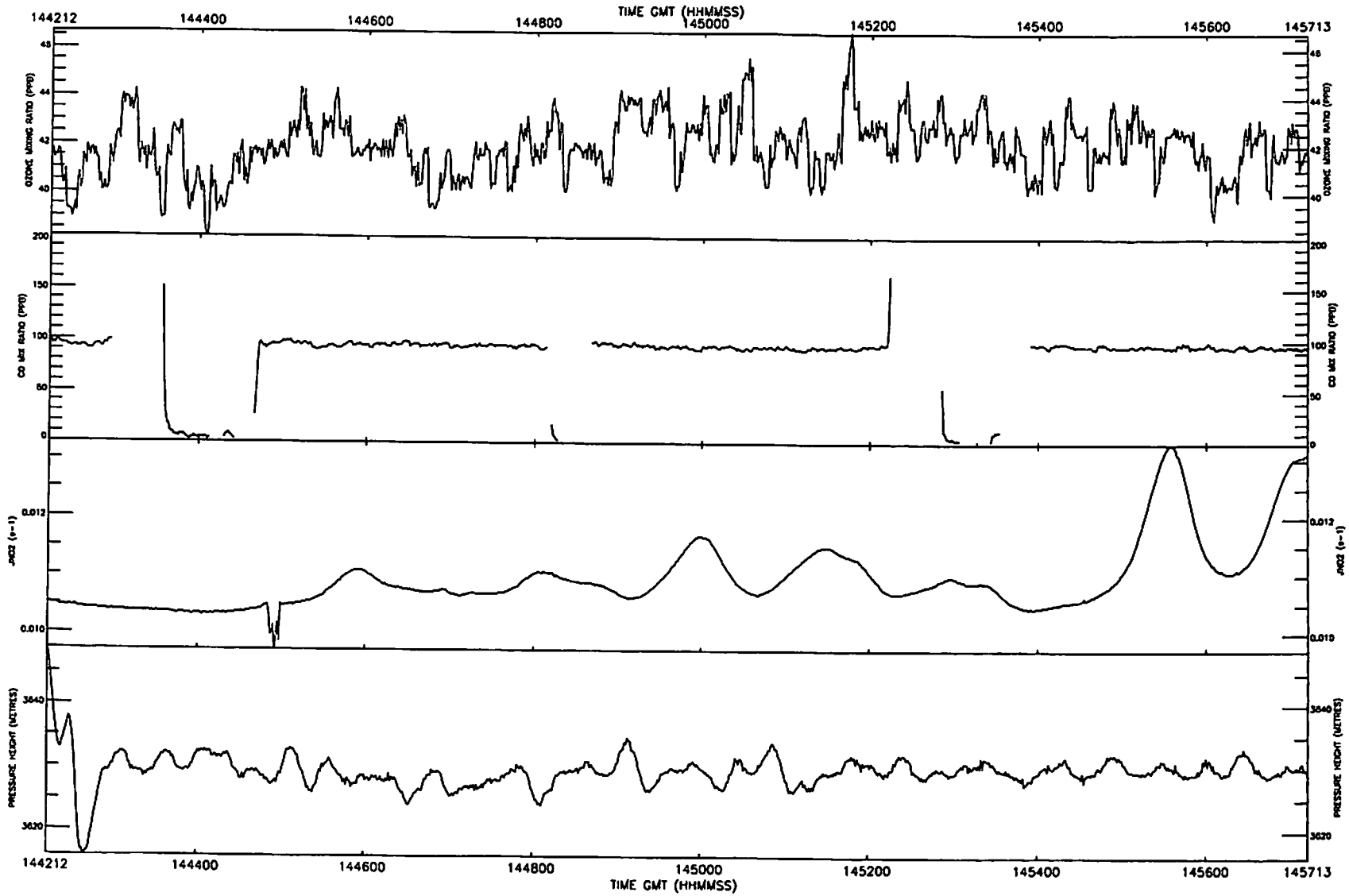
A478 13-SEP-96 R5 FL120 From 144212-145713 *Plotted 11-Oct-1996 15:36*



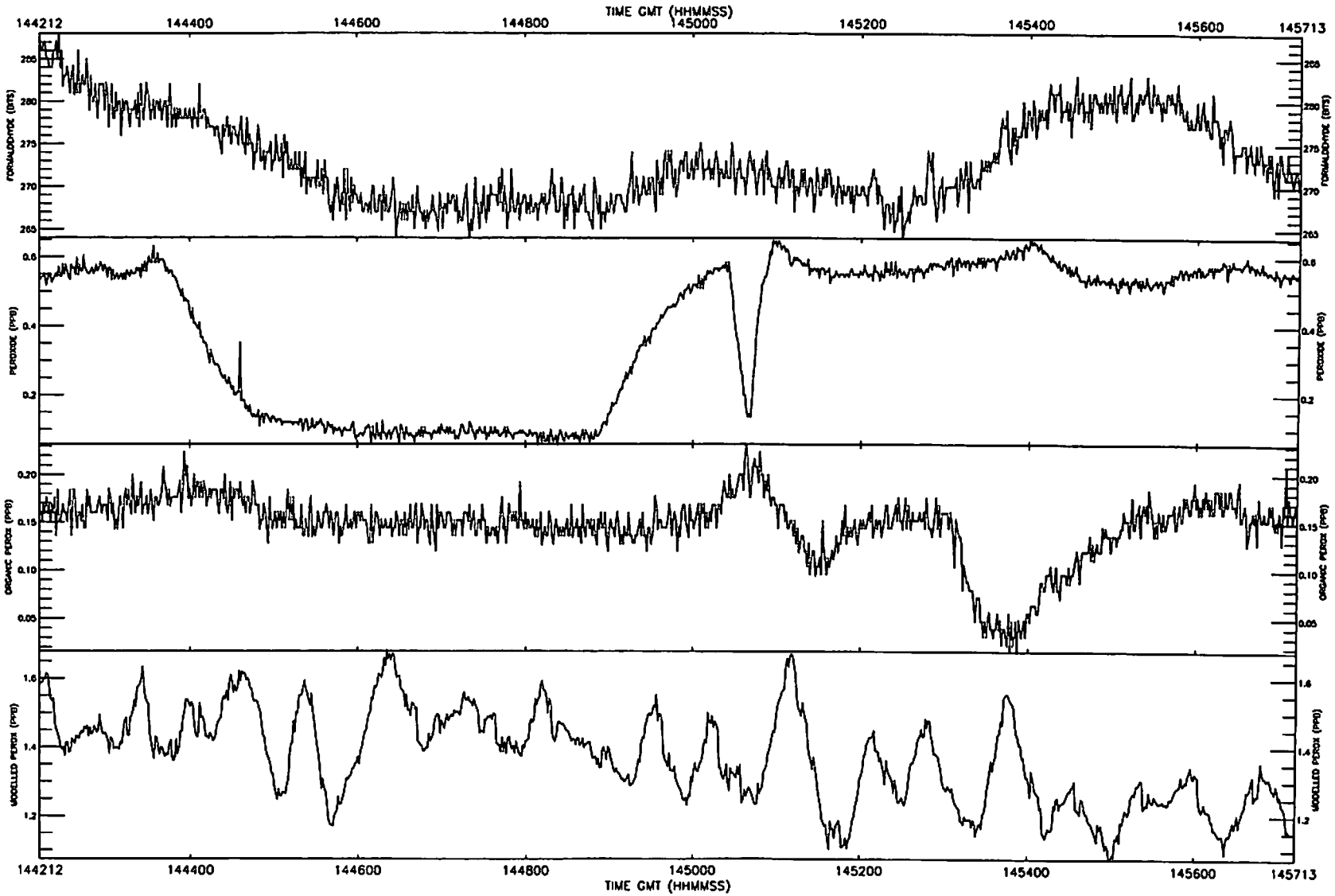
A478 13-SEP-96 R5 FL120 From 144212-145713 *Plotted 11-Oct-1996 15:36*



A478 13-SEP-96 R5 FL120 From 144212-145713 *Plotted 11-Oct-1996 15:36*



A478 13-SEP-96 R5 FL120 From 144212-145713 *Plotted 11-Oct-1996 15:36*



A478 13-SEP-96 R5 FL120 From 144212-145713 *Plotted 11-Oct-1996 15:37*

STATIC PRESSURE (MB)
No of obs 902
Mean 646.747
Standard dev 0.220381
Max value 647.877
Min value 645.143

DEICED TRUE TEMP (DEG K)
No of obs 902
Mean 269.821
Standard dev 0.385074
Max value 270.822
Min value 268.919

DEW POINT (DEG K)
No of obs 902
Mean 261.032
Standard dev 1.30216
Max value 263.255
Min value 258.209

OZONE MIXING RATIO (PPB)
No of obs 902
Mean 41.9316
Standard dev 1.24497
Max value 46.6679
Min value 38.1755

PCASP CONCENTRATION (CM-3)
No of obs 902
Mean 6.64722
Standard dev 3.63888
Max value 21.0041
Min value 0.000000

FSSP CONCENTRATION (CM-3)
No of obs 902
Mean 0.000000
Standard dev 0.000000
Max value 0.000000
Min value 0.000000

PRESSURE HEIGHT (METRES)
No of obs 902
Mean 3629.50
Standard dev 2.63893
Max value 3648.72
Min value 3615.97

CORRECTED LATITUDE (DEGREES)
No of obs 902
Mean 53.3377
Standard dev 0.417104
Max value 54.0595
Min value 52.6176

CORRECTED LONGITUDE (DEGREES)
No of obs 902
Mean -0.208618
Standard dev 0.121370
Max value -2.880605e-03
Min value -0.417258

NORTHWARD WIND COMPT (M S-1)
No of obs 902
Mean -20.4852
Standard dev 0.625631
Max value -19.3029
Min value -21.9037

EASTWARD WIND COMPT (M S-1)
No of obs 902
Mean -2.90885
Standard dev 0.648963
Max value -1.12576
Min value -4.77789

VERTICAL WIND COMPT (M S-1)
No of obs 902
Mean 0.166413
Standard dev 0.371635
Max value 1.18378
Min value -0.775879

WIND SPEED (MS-1)
No of obs 902
Mean 20.7001
Standard dev 0.649205
Max value 22.2642
Min value 19.4154

WIND DIRECTION (DEG)
Mean 8.08185

TRUE AIR SPEED (M S-1)
No of obs 902
Mean 160.182
Standard dev 0.677493
Max value 161.371
Min value 155.362

HEADING (DEG)
Mean 189.755

Glossary

Aircraft Position, Speed and Attitude

- **Navigation:** The aircraft carries GPS, OMEGA, and inertial navigation systems. Pitch and yaw are only displayed for flight A480, where specific manoeuvres were used to test the response of the NOxy inlets.

- **Pressure height:** is based on the standard atmosphere as specified by the International Civil Aviation Organisation (sea level pressure of 1013.25 hPa). Pressure height is quoted in terms of Flight Levels (height in hundreds of feet *e.g.* FL100 = 10000 feet).

- **Radar height:** altitude of the aircraft above surface, measured by radar.

- **Time:** All times are UTC.

General meteorology

- **Tephigrams:** are given for every major profile of each flight. A tephigram is a thermodynamic diagram (temperature (T) - entropy (ϕ) diagram) used to assess the static stability of a given atmospheric profile. Other meteorological organisations use similar diagrams such as the Emagram or the Skew T log p diagram.

- **Deiced true temperature:** air temperature with corrections for aircraft speed and altitude.

- **Potential temperature:** the temperature that a parcel of air would have if it follows a dry adiabatic lapse rate to the 1000 hPa level.

- **Dew point:** dew point (the temperature at which a sample of air would just become saturated with respect to a plane surface of water if cooled at a constant pressure) calculated from the chilled mirror General Eastern hygrometer.

- **FWVS Dew point:** dew point calculated by use of the Lyman-α spectroscopic instrument "the fluorescence water vapour sensor".

Cloud Physics

- **PCASP:** The Passive Cavity Aerosol Sampling Probe counts number concentrations (number per cm^3) of particles in 15 channels spaced pseudo-logarithmically over the diameter range 0.10 μm to 3.00 μm, to provide a particle size distribution over this range.

- **FSSP:** The Forward Scattering Spectrometer Probe is used to measure water droplets in the size range 0.5 to 47.0 μm diameter (cloud droplets). It has four range settings, each of which is divided into 15 size channels.

Chemistry Parameters

- **Ozone:** Calibrated readings from the TECO 49 ozone analyser in ppb. Instrument scientist: Joss Kent (UK Met. Office).

- **CO:** Raw data recorded in ppb. Instrument scientists: Christoph Gerbig and Stefan Kessler (KFA Julich).

- **JNO_2:** The sum of upward and downward facing radiometers (raw data). Instrument scientists: Christoph Gerbig and Stefan Kessler (KFA Julich).

- **Hydrogen peroxide:** Raw data recorded in ppb. Instrument scientist: Brian Bandy (UEA Norwich).

- **Organic peroxide:** Raw data recorded in ppb. Instrument scientist: Brian Bandy (UEA Norwich).

- **Modelled peroxide:** hydrogen peroxide concentrations as estimated from the concentrations of ozone and water vapour concentrations according to the following algorithm. The model is used in flight and is included in this data summary for individual scientists assessment of the use of algorithms for the purpose of in flight planning. Contact Brian Bandy, Claire Reeves (UEA, Norwich) or Dave Tiddeman (UK Met. Office) for details.

$$H_2O_2 = (k_3 j_4[O_3][H_2O])/(k_5[M](j_6+k_7+[OH]k_8)$$

where k_3 is the rate coefficient for the reaction: $O(^1D) + H_2O \rightarrow 2OH$
k_5 is the rate coefficient for the reaction: $O(^1D) + M \rightarrow O(^3P) + M$
k_8 is the rate coefficient for the reaction: $OH + H_2O_2 \rightarrow H_2O + HO_2$
k_7 is the first order loss due to dry deposition. However, as the boundary layer is difficult to define, this term has been ignored for the time being.
j_4 is the rate coefficient for the reaction: $O_3 + h\nu \rightarrow O(^1D) + O_2$
j_6 is the rate coefficient for reaction: $H_2O_2 + h\nu \rightarrow OH + OH$
j_4, j_6 and [OH], calculated by a 2D model, are dependent upon latitude and time of year.

- **Formaldehyde:** Raw data recorded as bits. NB this instrument has a long time delay *ca.* 12 minutes. Instrument scientist: Laura Cardenas (UEA, Norwich).

- **NOxy:** Parameters were not recorded on MRF's data recording system and are therefore not available as part of this data summary. Instrument scientist: Stephane Bauguitte (UEA, Norwich).

- **PAN ECGC's:** Data are not included in this report but will be made available at a later date. Instrument scientist: Joss Kent (UK Met. Office).

- **Bottles:** Please refer to the bottle flight logs (within the flight folder section to see when these were filled). Bottle filler: David Tiddeman (UK Met. Office).

Natural Environment Research Council

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METEOROLOGICAL OFFICE